JENNIFER RAE GUNTER
Email: Jennof4@gmail.com
1601 G St., The Dalles, OR 97058
Phone: 541-993-5366
ROBERT JAY SCHWARTZ
Email: udidya@gmail.com
3135 Mill Creek Road, The Dalles, OR 97058
Phone: 541-296-8988
HOLLY LYNN GOVE
Email: Hollygove1969@gmail.com
421 W. 15th St, The Dalles, OR 97058
Phone: 541-993-4707
CHELSEA ELIZABETH PERRITT
Email: chelseaperritt@gmail.com
219 W. 14th Street, The Dalles, OR 97058
Phone: 503-437-8370

Plaintiffs, appearing Pro Se

UNITED STATES DISTRICT COURT

DISTRICT OF OREGON

PORTLAND DIVISION

JENNIFER RAE GUNTER, individually and as a natural parent of A.G.; ROBERT JAY SCHWARTZ, individually and as a natural parent of J.S.; HOLLY LYNN GOVE, individually and as a natural parent of M.G.; CHELSEA ELIZABETH PERRITT, individually and as a natural parent of L.P.

Plaintiff(s),

v.

NORTH WASCO COUNTY SCHOOL DISTRICT BOARD OF EDUCATION;

Case No.: 3:21-CV-1661-YY

VERIFIED COMPLAINT

95688

CAROLYN BERNAL, in her individual capacity and in her official capacity as Superintendent of the North Wasco County Public School District; and REBECCA THISTLETHWAITE, DAWN RASMUSSEN, DAVID JONES, JOHN NELSON, BRIAN STEVENS, JOSE APARICIO, JUDY RICHARDSON, all in their individual capacities and in their capacities as members of the North Wasco County School District Board of Education,

Defendant(s)

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v.

Case No.:

NORTH WASCO COUNTY SCHOOL DISTRICT BOARD OF EDUCATION; CAROLYN BERNAL, in her individual capacity and in her official capacity as Superintendent of the North Wasco County Public School District; and REBECCA THISTLETHWAITE, DAWN RASMUSSEN, DAVID JONES, JOHN NELSON, BRIAN STEVENS, JOSE APARICIO, JUDY RICHARDSON, all in their individual capacities and in their capacities as members of the North Wasco County School District Board of Education,

Defendant(s).

VERIFIED COMPLAINT FOR DECLARATORY JUDGEMENT

Plaintiffs, A.G. minor, by and through her parent, Jennifer Rae Gunter, J.S. minor, by and through his parent, Robert Jay Schwartz, M.G. minor, by and through her parent, Holly Lynn Gove, and L.P. minor, by and through her parent, Chelsea Elizabeth Perritt, *pro se*, hereby file

this Complaint against Defendants, North Wasco County School District Board of Education ("School Board"); Carolyn Bernal, in her individual capacity and in her official capacity as Superintendent of the North Wasco County School District; and Rebecca Thistlethwaite, Dawn Rasmussen, David Jones, John Nelson, Brian Stevens, Jose Aparicio, and Judy Richardson, all individual elected officials sued in their individual capacity and in their capacity as members of the School Board (collectively, "Defendants"). In support of the claims set forth herein, Plaintiffs allege and aver as follows:

PARTIES

1. Plaintiff P.M.'s are minor children who reside in North Wasco County School District ("NWCSD"), in Wasco County, Oregon. Plaintiff P.M. are and were at all times relevant hereto students at a North Wasco County School District public school. Suit is brought herein on P.M.'s behalf by their Parents, Plaintiff(s) Jennifer Rae Gunter (PM A.G.), Robert Jay Schwartz ND LAC (PM J.S.), Holly Lynn Gove (PM M.G.), and Chelsea Elizabeth Perritt (PM L.P.).

2. Plaintiff(s) Jennifer Rae Gunter, Robert Jay Schwartz ND LAC, Holly Lynn Gove, and Chelsea Elizabeth Perritt are adult individuals who are residents and taxpayers in the North Wasco County School District, in Wasco County, Oregon. Plaintiff(s) Jennifer Rae Gunter (PM A.G.), Robert Jay Schwartz ND LAC (PM J.S.), Holly Lynn Gove (PM M.G.), and Chelsea Elizabeth Perritt (PM L.P) are the parents of Plaintiff P.M's.

3. Defendant North Wasco County School District Board of Education (the "School Board" or the "Board") is a public entity which, acting under color of law, is responsible for the formulation and implementation of all official governmental laws, policies, regulations and procedures in effect for the North Wasco County School District.

4. Defendant Dr. Carolyn Bernal was at all relevant times the Superintendent of the North Wasco County School District; in that capacity, acting under color of law, she is responsible for the implementation of all official governmental laws, policies, regulations and procedures governing the North Wasco County School District. She is sued in her official and individual capacities.

5. Defendant Rebecca Thistlethwaite is a Wasco County resident and member of the School Board, sued here in her individual and representative capacity. Ms. Thistlethwaite is currently the Director for Zone 1.

6. Defendant Dawn Rasmussen, is a Wasco County resident and member of the School Board, sued here in her individual and representative capacity. Mrs. Rasmussen is currently the Director of Zone 2.

7. Defendant David Jones is a Wasco County resident and member of the School Board, sued here in his individual and representative capacity. Mr. Jones is currently the Vice Chair and responsible for Zone 3.

8. Defendant John Nelson is a Wasco County resident and member of the School Board, sued here in his individual and representative capacity. Mr. Nelson is currently the Director for Zone 4.

9. Defendant Brian Stevens, is a Wasco County resident and member of the School Board, sued here in his individual and representative capacity. Mr. Stevens is currently the Director of Zone 5.

10. Defendant Jose Aparicio is a Wasco County resident and member of the School Board, sued here in his individual and representative capacity. Mr. Aparicio is currently the Director of Zone 6.

11. Defendant Dr. Judy Richardson is a Wasco County resident and member of the School Board, sued here in her individual and representative capacity. Ms. Richardson is currently the Director of Zone 7.

12. At all relevant times hereto, the School Board and the individual Defendants were acting under color of state law.

JURISDICTION AND VENUE

13. Plaintiffs incorporate the foregoing paragraphs as if set forth in full herein.

14. This Court has subject matter jurisdiction over Plaintiffs' claims under 28 U.S.C. §1331, 28 U.S.C. §§1343(a)(3), (4), 28 U.S.C. §1367, 28 U.S.C. § 2201, and 42 U.S.C. §1983.

15. There exists an actual and justiciable controversy between Plaintiffs and Defendants requiring resolution by this Court.

16. Plaintiffs have no adequate remedy at law.

17. Venue is proper before the United States District Court for the District of Oregon – Portland under 28 U.S.C. §1391 because all parties reside or otherwise are found herein, and all acts and omissions giving rise to Plaintiffs' claims occurred in the District of Oregon.

FACTS

A. Parental Rights

18. The United States Supreme Court has long recognized that parents have a fundamental liberty interest, under the Due Process Clause of the Fourteenth Amendment, in the care, custody, and control of their children. See, e.g., Prince v. Massachusetts, 321 US 158, 166, 64 S Ct 438, 88 L Ed 645 (1944) ("It is cardinal with us that the custody, care and nurture of the child reside first in the parents, whose primary function and freedom include preparation for obli-gations the state can neither supply nor hinder.")

19. In 2000, the Supreme Court cited a long train of previous cases which showed that the right of parents to direct the education and upbringing of their children is a fundamental right. The following passage, taken from ***Troxel v. Granville***, highlights the rich history of this fundamental right:

In subsequent cases also, we have recognized the fundamental right of parents to make decisions concerning the care, custody, and control of their children. See, e.g., ***Stanley v. Illinois***, 405 U.S. 645, 651, 92 S.Ct. 1208, 31 L.Ed.2d 551 (1972) ("It is plain that the interest of a parent in the companionship, care, custody, and management of his or her children 'come[s] to this Court with a momentum for respect lacking when appeal is made to liberties which derive merely from shifting economic arrangements'" (citation omitted)); ***Wisconsin v. Yoder***, 406 U.S. 205, 232, 92 S.Ct. 1526, 32 L.Ed.2d 15 (1972) ("The history and culture of Western civilization reflect a strong tradition of parental concern for the nurture and upbringing of their children. This primary role of the parents in the upbringing of their children is now established beyond debate as an enduring American tradition"); ***Quilloin v. Walcott***, 434 U.S. 246, 255, 98 S.Ct. 549, 54

L.Ed.2d 511 (1978) ("We have recognized on numerous occasions that the relationship between parent and child is constitutionally protected"); *Parham v. J. R.*, 442 U.S. 584, 602, 99 S.Ct. 2493, 61 L.Ed.2d 101 (1979) ("Our jurisprudence historically has reflected Western civilization concepts of the family as a unit with broad parental authority over minor children. Our cases have consistently followed that course"); ***Santosky v. Kramer***, 455 U.S. 745, 753, 102 S.Ct. 1388, 71 L.Ed.2d 599 (1982) (discussing "[t]he fundamental liberty interest of natural parents in the care, custody, and management of their child"); ***Glucksberg***, *supra*, at 720, 117 S.Ct. 2258 ("In a long line of cases, we have held that, in addition to the specific freedoms protected by the Bill of Rights, the 'liberty' specially protected by the Due Process Clause includes the right ... to direct the education and upbringing of one's children" (citing ***Meyer* and *Pierce***)). In light of this extensive precedent, it cannot now be doubted that the Due Process Clause of the Fourteenth Amendment protects the fundamental right of parents to make decisions concerning the care, custody, and control of their children. (Emphasis added)

B. North Wasco County School District Board of Education

20. The North Wasco County School District Board of Education is composed of seven citizens who are representatives of the residents of the North Wasco County Public School Area. Board members are elected 'at large' on a nonpartisan ballot and 3 or four seats are up for election on a staggered basis every odd-numbered year in the Spring. Members serve 4-year terms.

21. The seven individuals currently serving as School Board Members are Defendants Rebecca Thistlethwaite, Dawn Rasmussen, David Jones, John Nelson, Brian Stevens, Jose Aparicio, and Judy Richardson.

22. Defendant Dr. Carolyn Berna, Superintendent of the District, holds a Doctorate in Educational Leadership, a Master of Arts in Educational Leadership and Policy Studies, and a Bachelor of Arts in English.

23. Defendant Rebecca Thistlethwaite, Director for Zone 1 has a B.S. in Natural Resources Management, M.S. in International Agricultural Development, and a professional certificate in health and life coaching. On July 22nd, 2021, Rebecca Thistlethwaite swore her Oath of Office to support the Constitution of the United States, the Constitution and laws of the

State of Oregon, and the policies of the North Wasco County School District to the best of her ability. **See Exhibit A.**

24. Defendant Dawn Rasmussen, Director of Zone 2, no formal education found. On July 9th, 2019, Dawn Rasmussen swore her Oath of Office to support the Constitution of the United States, the Constitution and laws of the State of Oregon, and the policies of the North Wasco County School District to the best of her ability. **See Exhibit A.**

25. Defendant David Jones, Vice Chair and responsible for Zone 3, no formal education found. On July 9th, 2019, David Jones swore his Oath of Office to support the Constitution of the United States, the Constitution and laws of the State of Oregon, and the policies of the North Wasco County School District to the best of his ability. **See Exhibit A.**

26. Defendant John Nelson, Director for Zone 4, has a bachelor's degree in Landscape Architecture at the University of California at Berkeley and returned as a graduate student in Education earning a teaching credential for life in California and a basic license in Oregon. On July 22nd, 2021, John Nelson swore his Oath of Office to support the Constitution of the United States, the Constitution and laws of the State of Oregon, and the policies of the North Wasco County School District to the best of his ability. **See Exhibit A.**

27. Defendant Brian Stevens, Director of Zone 5, no formal education found. On July 22nd, 2021, Brian Stevens swore his Oath of Office to support the Constitution of the United States, the Constitution and laws of the State of Oregon, and the policies of the North Wasco County School District to the best of his ability. **See Exhibit A.**

28. Defendant Jose Aparicio, Director of Zone 6, no formal education found. On July 9th, 2019, Jose Aparicio swore his Oath of Office to support the Constitution of the United States, the Constitution and laws of the State of Oregon, and the policies of the North Wasco County School District to the best of his ability. **See Exhibit A.**

29. Defendant Dr. Judy Richardson, Director of Zone 7, holds a Bachelor of Science from the University of Puget Sound, is a Doctor of Medicine from Dartmouth, and holds an MBA from Oregon Health and Science University. On July 22nd, 2021, Dr. Judy Richardson swore her Oath of Office to support the Constitution of the United States, the Constitution and laws of the State of Oregon, and the policies of the North Wasco County School District to the best of her ability. **See Exhibit A.**

30. Defendant Dr. Carolyn Bernal has led the North Wasco County Public Schools as Superintendent on or around July 1st, 2021.

31. As Superintendent, Dr. Carolyn Bernal is charged with the administration of the NWCSD.

C. Relevant Policies of the North Wasco County School Board of Education

32. The Board's District-Community Relations Goals and Objectives state:

The Board's goal of achieving positive school-community relations serves to........

5. Foster public understanding of the need for constructive change and **solicit public advice** on achieving educational goals;

6. **Involve citizens** in solving educational problems;

7. **Promote cooperation** between the school and the community and **share the leadership** for improving community life.

Achieving these objectives requires that the Board and staff, individually and collectively, express positive attitudes toward the schools in their daily contacts **with parents**, community members and one another; make systematic, honest and continuing efforts to discover what the public thinks and what citizens want to know; interpret school programs, problems and accomplishments; **develop an active partnership with the community in working toward improvement of the educational program; and take an active interest in the needs of the community** to find ways to make the community a better place to live. **(Emphasis Added) Exhibit B.**

33. According to North Wasco County School District Board Powers and Duties:

2. Judicial Authority

As provided bylaw, policy or contract, **the Board acts as a fact-finding body** or a court of appeal **for** staff members, **students and the public when issues involve Board policies or agreements** and their implementation, and when the Board must determine the rights, duties or obligations of those who address the Board. **(Emphasis added) See Exhibit C.**

34. North Wasco County's Parental Rights document states:

The Board recognizes the importance of promoting parental input in decision making related to their student's health and general well-being.... **See Exhibit D.**

35. **The Student Rights and Responsibilities Policy states:**

1. Civil rights — including the rights to equal educational opportunity and freedom from discrimination; the responsibility not to discriminate against others;
2. The right to attend free public schools; the responsibility to attend school regularly and to observe school rules essential for permitting others to learn at school;
3. The right to due process of law with respect to suspension, expulsion and decisions which the student believes injure his/her rights; **See Exhibit E**

36. The Board Member Standards of Conduct provides states A Board member should:

Section 2. Understand that the Board sets the standards for the district through Board policy. Board members do not manage the district on a day-to-day basis;

Section 5. Recognize that policy decisions must be made only after full discussion at publicly held Board meetings;

Section 10. Recognize that the Board must comply with the Public Meetings Law and only has authority to make decisions at properly noticed Board meetings;

Section 19. Respect the right of the public to attend and observe Board meetings;

Section 24. **A Board member is a mandatory reporter of child abuse.** A Board member having reasonable cause to believe that any child with whom the Board member comes in contact with has suffered abuse or that any person with whom the Board member comes in contact with has abused a child shall immediately make an oral report by telephone or otherwise to the local Department of Human Services (DHS), to the designee of the department or to a local law enforcement within the county where the person making the report is located at the time of contact; **(Emphasis added) See Exhibit F.**

37. The Student Dress and Grooming Policy Notes:

Responsibility for dress and grooming rests primarily with students and their parents. However, the district expects student dress and grooming to **meet standards which ensure that the following conditions do not exist**:

2. **Threat to the health and/or safety of the student** concerned or of other students. **(Emphasis added) See Exhibit G.**

38. The Hazing/Harassment/Intimidation/Bullying/Menacing/Cyberbullying/ Teen Dating Violence, or Domestic Violence – Student Policy states:

Hazing, **harassment, intimidation, menacing or bullying** and acts of cyberbullying **by** students, **staff**, or third parties **towards students is strictly prohibited**.

"Harassment, intimidation or bullying" means any act that substantially interferes with a student's educational benefits, opportunities or performance, that takes place on or immediately adjacent to district grounds, at any district-sponsored activity, on district-provided transportation, or at any official district bus stop, that may be based on, but not limited to, the protected class status of a person, having the effect of:

1. Physically harming a student or damaging a student's property;

2. Knowingly placing a student in reasonable fear of physical harm to the student or damage to the student's property; or

3. Creating a hostile educational environment including interfering with the psychological well-being of the student. (Emphasis added) **See Exhibit H**

D. Relevant meetings, definitions, laws, rules that pertain to the case.

39. On August 12, 2021 the North Wasco County School Board hosted a Community "Listening Session" for families, staff and community members to speak in person, comment via Zoom or submit written comments. **See Exhibit I**

The North Wasco County School District Board then presented the draft of the Safe Return to In-Person Instruction and Continuity of Services Plan at the August 19th Meeting. **See Exhibit J.**

During the August 26, 2021 Regular School Board Meeting (Page 6), Dr. Bernal reported that the Safe Return to In Person Instruction and Continuity of Instruction Plan is due to ODE tomorrow, which information included this year is very different from last year's blueprints. She noted that staff is finalizing the district's communicable diseases plan and once completed, this plan will be available on the district's website. **See Exhibit K**

The North Wasco County School Board's (above and **Exhibit B**) policies goal of achieving positive school-community relations serves to solicit public advice, involve citizens, promote cooperation, share leadership, and develop an active partnership with the community.

At no time did the North Wasco County School Board solicit public input or involve citizens in an active partnership prior to implementing the Safe Return to In Person Instruction and Continuity of Services Plan for the 2021 School Year.

The fundamental liberty interests of parents to the care, custody and maintenance of their minor children are violated, deprived, harmed, usurped, and infringed upon each school day as said children are forced to wear face mask or face coverings without Petitioner's consent.

40. Plaintiff Jennifer Gunter spoke at the August 26, 2021 board meeting stating the following:

The D 21 school board has decided to force children to wear a mask based on "science" without any sound legal qualification…

Actual science would have been that the state of Oregon and or District 21 actually conducted an air quality test that would consist of bringing in an Environmental Toxicologist/industrial hygienist to do air sampling during D21 classes…

Plaintiff urged the school district to request an investigation and proposal of intervention into Oregon state mandates that claim science and her suggestions and request was ignored. **See Exhibit K, Page 2 and 10.**

41. Plaintiff Jennifer Gunter sent a letter along with attachments (**Exhibit v and iv**) to the North Wasco County School Board on October 7, 2021 requesting they review the data from

verified case expert Steven Petty. Her letter also requested verifiable data and studies that deemed the school should remain masked.

Additionally, under point 6 of her letter, she again requested that a certified industrial hygienist test be conducted.

On October 15, 2021 the North Wasco County School Board returned Plaintiff Gunter's' request showing they declined Plaintiff's request for an industrial hygienist evaluation and cited the same reference for the majority of her questions under OAR 333-019-1015. **See Exhibit L.**

42. According to the Guidance for COVID-19 Prevention in K-12 Schools, they use the word "recommends". **See Exhibit M.**

43. Under the Ready Schools, Safe Learners Resiliency Framework for the 2021-20922 School Year, Page 2 denotes:

The vast majority of health and safety measures in this Resiliency Framework **are advisory**, and are offered to schools to support successful full-time, in-person instruction for the 2021-22 school year. **Where this framework does not require a specific action by a school district, a district may choose whether to consider or implement advisory information or recommendations.**

Nothing in this framework is intended to provide legal advice. **ODE encourages districts to consult with their own legal counsel and to consider other state and federal guidance and laws when implementing any recommendations.** (Emphasis added)

On Page 3 this document also states:

Oregon OSHA enforces workplace safety rules and statutes. See Exhibit N

44. According to the USDA Food Safety and Inspection Service website on Carbon Dioxide - https://www.fsis.usda.gov/sites/default/files/media_file/2020-08/Carbon-Dioxide.pdf

What OSHA standards and exposure guidelines apply? OSHA has established a Permissible Exposure Limit (PEL) for CO2 of 5,000 parts per million (ppm) (**0.5% CO2** in air) averaged over an 8-hour work day (time-weighted average or TWA.) (Emphasis added) **See Exhibit O.**

45. According to the CDC website: https://www.cdc.gov/regulations/index.html

CDC and other agencies **implement public health laws passed by Congress** through Federal Regulations. After a Congressional bill becomes law, federal agencies may be

responsible for putting the law into action through the development of regulations. **(Emphasis added) See Exhibit P.**

A "Recommendation" is NOT a law passed by Congress so it should not be treated as such for Children in the absence of verifiable data from industrial hygienist testing and or upon completely verified parental consent.

46. According to the OSHA Office of Training and Education on page 1 under Introduction:

Industrial hygiene has been defined as "that science and art devoted to the anticipation, recognition, evaluation, and control of those environmental factors or stresses arising in or from the workplace, which may cause sickness, impaired health and well-being, or significant discomfort among workers or among the citizens of the community." Industrial hygienists use environmental monitoring and analytical methods to detect the extent of worker exposure and employ engineering, work practice controls, and other methods to control potential health hazards. **See Exhibit Q.**

47. On 29 Feb 2020, the U.S. Surgeon General posted the following on Twitter:

"Seriously people- STOP BUYING MASKS!"

"They are NOT effective in preventing general public from catching #Coronavirus..".

See Exhibit R

48. According to a Research Report on Mask Mandates in Schools, "CDC Ignores Research, Or Lack Thereof, And Recommends Mask Mandates for Students in Schools". **See Exhibit S** for references from respected professionals and organizations.

49. Given Defendants refused to hear or act upon Plaintiff's request to halt the mask requirement or for an Industrial Hygiene Test, Plaintiff Gunter ran a test using a Storex O2 & CO2 Analyser on her own child. Tests were performed using a K95 Mask and Generic Surgical mask while her child was at rest.

At 1:39 of the K95 test, Plaintiff's child showed 2.71% CO2 level (5x higher than the OSHA Limit) - https://www.youtube.com/watch?v=NifpIynmviA

At 2:17 of the Surgical Mask test, Plaintiff's child showed 2.62% CO_2 level (5x higher than the OSHA Limit) - https://www.youtube.com/watch?v=h8dGtY47qGY

50. Furthermore, Juvenile Code: Dependency ORS 419B.005 (Definitions) states as follows:

1) **(a) "Abuse" means:**

(B) **Any mental injury to a child**, which shall include only observable and **substantial impairment of the child's mental or psychological ability to function caused by cruelty to the child**, with due regard to the culture of the child.

(F) **Negligent treatment or maltreatment of a child**, including but not limited to the failure to provide adequate food, clothing, shelter or **medical care that is likely to endanger the health or welfare of the child.**

(G) **Threatened harm to a child, which means subjecting a child to a substantial risk of harm to the child's health or welfare**.

(Emphasis added) **See Exhibit T.**

51. Additionally, ORS 339.288 Prohibitions on use of certain restraints

(1) The use of the following types of restraint on a student in a public education program is prohibited:

(g) Any restraint that places, or creates a risk of placing, pressure on a student's mouth, unless the restraint is necessary for the purpose of extracting a body part from a bite.

(h) Any restraint that impedes, or creates a risk of impeding, breathing.

See Exhibit U and Plaintiff's YouTube Videos depicting decreased O2 and increased CO_2 levels.

https://www.youtube.com/watch?v=NifplynmviA,

https://www.youtube.com/watch?v=h8dGtY47qGY

52. The educational school year for 2021-2022 began on August 31, 2021, and for each school day thereafter, Petitioners are forced to choose either to mask their children against their will, or exercise their fundamental liberty interests in refusing to place face coverings on

their children and, as a result, the children to risk suspension/expulsion/isolation/seclusion from school

Additionally, compulsory attendance begins at age 6 in Oregon (ORS 339.010). Essential meaning of compulsory (https://www.merriam-webster.com/dictionary/compulsory):

1. : required by law or rule
   // compulsory [=mandatory] education/retirement
2. : having the power of forcing someone to do something
   // a compulsory law

Due to the Plaintiffs having to abide by the law set forth for parents, the health and safety of the children, and the mental distress caused to parents to comply with standards within Oregon laws for free and equal education of their minor children, the situation is dire in nature to preserve said parents' fundamental liberty interest to have the ultimate care custody and management of their children.

53. Article I § 34) *Slavery* or involuntary *servitude*. There shall be neither slavery, nor involuntary servitude in the State, otherwise than as a punishment for crime, whereof the party shall have been duly convicted. — [Added to Bill of Rights as unnumbered section by vote of the people at time of adoption of the Oregon Constitution in accordance with section 4 of Article XVIII thereof]. (Emphasis added).

Additionally, under ORS 163.261 Definitions for ORS 163.264 (Subjecting another person to involuntary servitude in the first degree), "Services" means activities performed by one person under the supervision or for the benefit of another person. [2007 c.811 §1].

Definition of *slavery* (https://www.merriam-webster.com/dictionary/slavery)

1 **a:** the practice of slaveholding
  b: the state of a person who is held in forced servitude
  c: a situation or practice in which people are entrapped (as by debt) and exploited

Definition of *servitude* (https://www.merriam-webster.com/dictionary/servitude)

1: a condition in which one lacks liberty especially to determine one's course of action or way of life

2: a right by which something (such as a piece of land) owned by one person is subject to a specified use or enjoyment by another

54. Plaintiffs minor Student movements everyday are impeded and mental ability to stay on task in the educational setting is impeded on by constant harassment of interruptions to re address masks that may fall below nose or rise above mouth when talking, outside recess times and lunch breaks. Students have been called out in front of peers for correct mask wearing, which endues mental distress, anxiety and constant worry often times being told to go to the office to replace their mask which takes away valuable core tax payer funded educational times and academic growth for plaintiff's minors.

Merriam webster Definition;

anxiety

1. A state of uneasiness and apprehension, as about future uncertainties.
2. A cause of anxiety.
3. A state of apprehension, uncertainty, and fear resulting from the anticipation of a realistic or fantasized threatening event or situation, often impairing physical and psychological functioning.

impede

1. To retard or obstruct the progress of. synonym: hinder.
2. To hinder; to stop in progress; to obstruct.

distress

1. To cause strain, anxiety, or suffering to. synonym: trouble.
2. To mar or otherwise treat (an object or fabric, for example) to give the appearance of an antique or of heavy prior use.
3. To constrain or overcome by harassment.

E. NWCSD's COVID-19-Based Measures

55. North Wasco County School District published the "Safe Return to In-Person Instruction and Continuity of Services Plan" to serve the following purposes for 2021 school year. The document contains several links and references which I will list below. **See Exhibit W** (emphasis added)

Excerpt:

2) Meets the requirements for:

a. An operational plan required under OAR 581-022-0106(4), while aligning the ***CDC Guidance*** on School Reopening with ***the Ready Schools, Safe Learners Resiliency Framework for the 2021-22 School Year*** (RSSL Resiliency Framework); ***(Emphasis Added)***

https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/k-12-guidance.html;

https://www.oregon.gov/ode/students-and-family/healthsafety/Pages/RSSL-Guidance.aspx;

b. Section 2001(i)(1*)* of the ARP ESSER and the US Department of ***Education's Interim Final Requirements*** for Safe Return/Continuity of Services Plan; and

https://www.federalregister.gov/documents/2021/04/22/2021-08359/american-rescue-plan-act-elementary-and-secondary-school-emergency-relief-fund

Under the American Rescue Plan Act Elementary and Secondary School Emergency Relief Fund, LEA Plan for Safe Return to In-Person Instruction and Continuity of Services, Interim Final Requirements section, it REQUIRES the following in order to be eligible for the program:

Interim Final **Requirement**: As described in more detail below, this requirement clarifies what an LEA's plan for the safe return to in-person instruction and continuity of services must address and requires periodic review and, when needed, revision of the plan to ensure it remains relevant and **meets statutory and regulatory requirements**.

First, **the requirement clarifies that an LEA's plan must include** how it will maintain the health and safety of students, educators, and other school and LEA staff, and the extent to which it has adopted policies, and a description of any such policies, on each of the **CDC's safety recommendations including: Universal and correct wearing of masks**; modifying facilities to allow for physical distancing (e.g., use of cohorts/podding); handwashing and

respiratory etiquette; **cleaning and maintaining healthy facilities, including improving ventilation**; contact tracing in combination with isolation and quarantine, in collaboration with the State, local, territorial, or Tribal health departments; diagnostic and screening testing; efforts to provide vaccinations to school communities; appropriate accommodations for children with disabilities with respect to health and safety policies; and coordination with State and local health officials. **See Exhibit X.**

Again, Respondents denied Plaintiff's request for an Industrial Hygiene test to confirm air quality and subsequently improve or rectify any issues that need to be addressed within the school which is clearly listed as a requirement of the LEA Plan noted above.

56. Every day Respondents require that school children wear masks to receive cares act funding aka ESSER or they could face harassment, intimidation, bullying, isolation or seclusion is a day Respondents require servitude.

Under ORS 163.261 Definitions for ORS 163.264 (Subjecting another person to involuntary servitude in the first degree), "Services" means activities performed by one person under the supervision or for the benefit of another person. [2007 c.811 §1].

57. Every day the respondents require that school children wear masks or they could face harassment, intimidation, bullying, isolation or seclusion is coercion to receive a free public education. https://www.merriam-webster.com/dictionary/coercing see ORS 163.275 (1) A person commits the crime of coercion when the person compels or induces another person to engage in conduct from which the other person has a legal right to abstain, or to abstain from engaging in conduct in which the other person has a legal right to engage, by means of instilling in the other person a fear that, if the other person refrains from the conduct compelled or induced or engages in conduct contrary to the compulsion or inducement, the actor or another will:

Students who do not wear their mask, or correctly, are docked points on the grading scale affecting students' valuable grades which affects their honor roll criteria and future college applications based on grades (**Exhibit Y**). These punishments are harassing and intimidating in

nature and coerce the child to comply by causing fear and anxiety which is in direct violation to the North Wasco County Harassment Policy (Exhibit H) and ORS 339.351 to 339.364.

Additionally, students who fail to follow the strict masking policies are given minor or major referrals' or directed to the administrator's office losing valuable educational time for the students when teacher corrects a medical device without a license. **See Exhibit Z**

58. Teachers, under the instruction of the "Safe Return to In-Person Instruction and Continuity of Services Plan" are prescribing a correction to correct mask wearing to any person or minor to whom is not sick or appear to be ill or has not been diagnosed by a licensed professional or a certified case matter expert constitutes practicing without a medical license. Under ORS 667.085 Section 4 this constitutes practice of medicine as: Offer or undertake to diagnose, cure or **treat in any manner**, or by any means, methods, **devices** or instrumentalities, any disease, illness, pain, wound, fracture, infirmity, deformity, defect or abnormal physical or mental condition of any person. (Emphasis added)

Merriam webster defines medicine as;

1. The science and art of diagnosing and treating disease or injury and maintaining health.
2. The branch of this science encompassing treatment by drugs, diet, exercise, and other nonsurgical means.
3. The practice of medicine.

Merriam webster defines correcting as;

correction

1. The act or process of correcting.
2. Something offered or substituted for a mistake or fault.
3. Punishment intended to rehabilitate or improve.

According to a District 21 Teacher Job Description, teachers are acting outside of their everyday job scope by prescribing proper mask wearing and policing. **See Exhibit AA.**

F. Plaintiffs Place Defendants on Notice of Lawsuit

59. Upon the North Wasco County's response to Plaintiff Gunter's letter dated October 7, 2021, Plaintiff's emailed the school board they would be filing a lawsuit due to the Defendants' violation of the Oregon Constitution, Oregon Laws, Parental Rights, and failure to safeguard children from abusive practices.

Plaintiffs concluded their letters by noting that they would be seeking a temporary restraining order unless the purported "requirements" were not rectified by the close of business on October 22, 2021. See also **Exhibit AB.**

G. The Masking Requirement Causes Immediate and Irreparable Harm to Students, Staff, and Community.

60. Attached as **Exhibit AC** is a signed Declaration from Stephen Petty regarding cloth face coverings or masks in school pursuant to ODE and OHA rules, policies and guidance. Stephen E. Petty, an expert in the field of Industrial Hygiene who has testified as to the futility and danger caused by an individual wearing a mask in order to avoid transmitting or becoming infected with Covid-19, states the following:

> ***
>
> 3. I hold relevant industry certifications including board certifications as a C.I.H. (Certified Industrial Hygienist), a C.S.P. (Certified Safety Professional), and as a P.E. (Professional Engineer) in six states (Florida, Kentucky, Ohio, Pennsylvania, Texas and West Virginia). My curriculum is attached hereto as **Exhibit i.**

4. I have served as an expert in personal protective equipment and related disciplines in approximately 400 legal cases. I have often been certified as, and provided testimony as, an expert in these areas. My list of representative cases is attached hereto as **Exhibit ii**.

5. For example, I am currently serving as an expert in the Monsanto Roundup and 3-M PFAS litigation. Recently I testified in four trials for the DuPont C-8 litigation.

6. I taught Environmental and Earth Sciences as an adjunct professor at Franklin University.

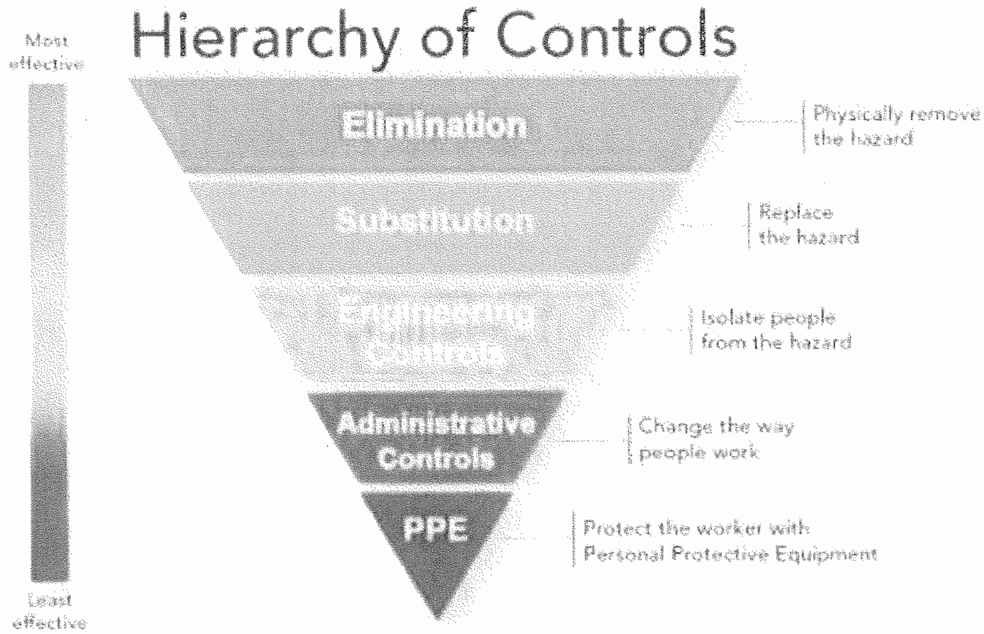
7. I hold nine U.S. patents, most related to heating, ventilation and air conditioning systems.

8. I am a current member in good standing of the following relevant associations: American Industrial Hygiene Association (AIHA), American Board of Industrial Hygiene (ABIH), American Conference of Governmental Ind. Hygienists (ACGIH), American Institute of Chemical Engineers (AIChE), American Society of Refrigeration, Air Conditioning and Refrigeration Engineers (ASHRAE); Member ASHRAE 40 Std. and TC 2.3, and Sigma Xi.

9. I am an expert in the field of Industrial Hygiene, which is the science and art devoted to the anticipation, recognition, evaluation, and control of those environmental factors or stressors — including viruses — arising in or from the workplace, which may cause sickness, impaired health and well-being, or significant discomfort among workers or among the citizens of the community.

10. Industrial Hygiene is fundamentally concerned the proper methods of mitigating airborne/dermal hazards and pathogens, as well as with the design and use of personal protective equipment, among other things.

11. Industrial hygienists refer to a "Hierarchy of Controls" that are typically implemented to minimize exposures, including exposures to very small airborne aerosols like SARS-CoV-2, the virus that causes COVID-19.



12. Regarding practical or "engineering" controls, industrial hygienists focus on practices that dilute, destroy, or contain airborne hazards (or hazards in general).

13. Personalized Protective Equipment (PPE) — especially facial coverings — do not dilute, destroy, or contain airborne hazards. Therefore, facial coverings are not part of the Industrial Hygiene (IH) Hierarchy of Controls. Even respirators (part of the PPE Category and classified separately from masks) are in the last priority on the Hierarchy of Controls.

14. Medical doctors, virologists, immunologists, and many public health professionals are experts at how a virus behaves inside the human body, but not qualified experts in how the virus behaves outside of the human body. This is the purview of industrial hygiene and infection control.

15. On May 7, 2021, the Centers for Disease Control (CDC) updated its guidance, providing that the primary mechanism for transmission of Covid-19 is through airborne aerosols, and not as the CDC previously stated, by touching contaminated surfaces or through large respiratory droplets.[1]

16. Airborne viral aerosols can consist of a single viral particle or multiple viral particles clumped together, and usually smaller than 5 μm (microns) in size. Covid aerosols are 0.1 μm in size. By comparison, droplets are >5 μm to >10 μm in size.

17. A square micron is approximately 1/4000th the area of the cross-section of a human hair and 1/88th the diameter of a human hair. SARS-CoV-2 particles are ~1/10 of a micron or ~1/40,000th the area of a cross section of a human hair or ~1/880th the diameter of a human hair.

18. A recent University of Florida study capturing air samples within an enclosed automobile cabin occupied by a Covid-positive individual showed that the only culturable Covid-19 virus samples obtained were between 0.25 μm to 0.5 μm in size.[2] Particles smaller than 5 μm are considered very small and/or very fine or aerosols.

19. Very small particles do not fall by gravity in the same way that larger particles can and do stay suspended in still air for a long time, even days to weeks.

20. Because they stay suspended in concentration in indoor air, very small particles can even accumulate and become more concentrated over time if the ventilation is poor.

21. Very small airborne aerosols pose a particularly great risk of exposure and infection because, since they are so small, they easily reach deep into the lung. This explains in part why Covid-19 is so easily spread, and why so little Covid-19 is required for infection.

22. Exposure to airborne aerosols is a function of two primary parameters: concentration and time. Less is better regarding both parameters. However, in a school environment, it is difficult to limit the amount of time students spend in a classroom.

23. For many reasons, personal protective equipment (PPE) is the least desirable way to protect people from very small airborne aerosols. A device referred to as a respirator (commonly referred to as an N95 Respirator) is required to provide such protection. Moreover, masks are not PPE since they cannot be sealed and do not meet the provisions of the Occupational Safety and Health Administration (OSHA) Respiratory Protection Standard (RPS), namely 29 CFR 1910.134.[3]

24. The AIHA, in its September 9, 2020 Guidance Document for COVID-19 noted that only risk reduction methods that provide greater than a 90% relative risk reduction should be considered; masks were shown to provide no great than a 10% relative risk reduction (see Figure 2), and far below the required 90% threshold.[4]

25. Similarly, a paper published on July 21, 2021 in the Journal Physics of Fluids, using ideally sealed masks and particles 1 µm in size, reported efficiencies for the more commonly used cloth masks and surgical masks of 10% and 12%, respectively.5 No mask can be perfectly sealed; thus "real world" effectiveness – particularly for children - is even lower.

26. Facial coverings are not comparable to respirators. Leakage occurs around the edges of ordinary facial coverings. According to the CDC's National Institute for Occupational Safety and Health, surgical masks "do NOT provide the wearer with a reliable level of protection from inhaling smaller airborne particles and is not considered respiratory protection. Leakage occurs around the edge of the mask when the user inhales."

27. Thus, ordinary facial coverings do not provide a reliable level of protection against inhalation of very small airborne particles and are not considered respiratory protection. The inability of the masks to achieve proper fit is particularly pronounced in children.

28. For example, during the seasonal forest fires in the summer of 2020, the CDC issued public guidance warning that facial coverings provide no protection against smoke inhalation. That is because facial coverings do not provide a reliable level of protection against the small particles of ash contained in smoke. Ash particles are substantially larger than Covid-19 aerosolized particles.

29. I have reviewed the Oregon Department of Education (ODE) and Oregon Health Authority (OHA) facial covering rules, guidance and policies[6] ; which mandate that children wear masks at all times while indoors at school, as well as requiring children wear masks while participating in many outdoor activities.

30. Ordinary facial coverings like the ones required by the ODE and OHA mask mandates do not meet any of the several key OSHA Respiratory Protection Standards (RPS) for respirators.

31. Because of the gaps around the edges of facial coverings required by ODE and OHA rules and policies, they do not filter out Covid-19 aerosols

32. Most over-the-counter disposable facial coverings have edge gaps of 10% or more. When adult-sized facial coverings are used by children, edge gaps will usually greatly exceed 10%. Ordinary facial coverings like the ones required by the ODE and OHA rules and policies do not provide any filtering benefit relative to particles smaller than 5 μm, if not properly sealed.

33. One study found that for aerosols $< 2.5\mu m$, mask filtration efficiency decreases by 66% for a relative leak area of 2%.7 Therefore, the effectiveness of a facial covering falls to essentially zero when there is a 3% or more open area in the edges around the sides of the facial covering.

34. The following pictures are cropped still frames from a video embedded in a KDRV news story entitled Schoolwatch: Full-Time In Person Learning Resumes For Medford School District8 . The video shows students from Wilson Elementary (in Medford, Oregon) being instructed on August 23, 2021 by a second grade teacher; then of the teacher being interviewed on the same day, while on school property. Shown are typical large gaps on both sides of the mask, which greatly exceed 10%, making the masks completely ineffective.

(students)

(teacher)

35. Prominently displayed on the Oregon Health Authority webpage[9] promoting the continued use of masks or cloth face coverings (including K-12 classrooms) is an embedded video from Multnomah County Health Department entitled Face Coverings Are Still Important[10]. At time 1:48, disposable medical masks are shown on screen, while the voice of the county health official admits, "…disposable masks are not designed to fit tightly…".

36. SARS-CoV-2 particles could immediately be substantially mitigated by:

a. opening windows and using fans to draw outdoor air into indoor spaces (diluting the concentration of aerosols),

b. setting fresh air dampers to maximum opening on HVAC systems,

c. overriding HVAC energy controls,

d. increasing the number of times indoor air is recycled,

e. installing needlepoint ionization technology to HVAC intake fans, and

f. installing inexpensive ultraviolet germicide devices into HVAC systems.

37. All of the above-referenced techniques are more effective and meet standard Industrial Hygiene Hierarchy of Controls (practices) for controlling exposures. The Hierarchy of Controls has been in place for nearly 100 years.

38. The use of cloth facial coverings does not fit within the basic Hierarchy of Controls since cloth face coverings and masks are not PPE and cannot be sealed. There are no OSHA standards for facial coverings (masks) as respiratory protection.

39. Extended use of respiratory PPE is not indicated without medical supervision.

40. There are a wide variety of well-known negative effects from wearing masks that have been thoroughly studied and reported for years. As explained in a paper published on April 20, 2021 in the International Journal of Environmental

Research and Public Health reviewing 44 experimental studies and 65 publications on adverse effects from masks, measurable physical effects including increased heart rates, respiratory rates and elevated CO2 retention were noted even from wearing surgical masks for as few as 30 minutes. [11]

41. In one of the referenced studies of 12 healthy young students, investigators observed dizziness, listlessness, impaired thinking and concentration problems when wearing masks.[12]

42. The paper summarized a lengthy list of negative effects from wearing masks that were reported in the literature, as follows:

Increased risk of adverse effects when using masks:

Internal diseases	**Psychiatric illness**	**Neurological Diseases**
COPD	Claustrophobia	Migraines and Headache Sufferers
Sleep Apnea Syndrome	Panic Disorder	Patients with intracranial Masses
advanced renal Failure	Personality Disorders	Epilepsy
Obesity	Dementia	
Cardiopulmonary Dysfunction	Schizophrenia	
Asthma	helpless Patients	
	fixed and sedated Patients	
Pediatric Diseases	**ENT Diseases**	**Occupational Health Restrictions**
Asthma	Vocal Cord Disorders	moderate / heavy physical Work
Respiratory diseases	Rhinitis and obstructive Diseases	
Cardiopulmonary Diseases		**Gynecological restrictions**
Neuromuscular Diseases	**Dermatological Diseases**	Pregnant Women
Epilepsy	Acne	
	Atopic	

Figure 5. Diseases/predispositions with significant risks, according to the literature found, when using masks. Indications for weighing up medical mask exemption certificates.

Example statements made in the paper include the following: "The overall possible resulting measurable drop in oxygen saturation (O2) of the blood on the one hand and the increase in carbon dioxide (CO2) on the other contribute to an increased noradrenergic stress response, with heart rate increase and respiratory rate increase, in some cases also to a significant blood pressure

increase." In fact, "Neither higher level institutions such as the WHO or the European Centre for Disease Prevention and Control (ECDC) nor national ones, such as the Centers for Disease Control and Prevention, GA, USA (CDC) or the German RKI, substantiate with sound scientific data a positive effect of masks in the public (in terms of a reduced rate of spread of COVID-19 in the population)." For these reasons, students who are required to wear masks pursuant to a mandate suffer immediate and irreparable injury, loss, or damage.

43. The authors note: "The overall possible resulting measurable drop in oxygen saturation (O2) of the blood on the one hand and the increase in carbon dioxide (CO2) on the other contribute to an increased noradrenergic stress response, with heart rate increase and respiratory rate increase, in some cases also to a significant blood pressure increase."[13]

44. In summarizing their findings, the authors conclude "…there are clear, scientifically recorded adverse effects for the mask wearer, both on a psychological and on a social and physical level."[9]

45. For these reasons, students who are required to wear cloth face coverings or masks in school pursuant to ODE and OHA rules, policies and guidance will likely suffer immediate and ongoing injury, both psychological, social and physical – which is detrimental to the learning environment

46. A recent summary of the literature on these topics shows:

a. PPE is the least desirable way to protect people from very small airborne aerosols.

b. Cloth facial coverings as required by ODE and OHA rules, policies and guidance are not recognized as PPE since they cannot be sealed and are not covered by the OSHA RPS.

c. If PPE were to be used for protection, respirators, not facial coverings as required by ODE and OHA, are needed to provide any effective protection from very small airborne aerosols.

d. Very small aerosol particles are more likely to be a greater cause of disease than respiratory droplets because they can evade PPE and reach deep into the lungs, whereas respiratory droplets have to work against gravity in order to travel up a person's nose into the sinus and typically rapidly fall to the ground.

e. Much better alternatives to controlling exposure are available (i.e., engineering controls of dilution – ventilation and destruction), and should be used to minimize exposures as opposed to masks.

f. Based on cited literature, individuals who are required to wear cloth face coverings or masks pursuant to a mandate have the known potential to suffer immediate and irreparable injury due to a measurable drop in oxygen saturation of the blood and increased carbon dioxide saturation levels, which contribute to an increased noradrenergic stress response, with associated heart rate and respiratory rate increases, and in some cases, a significant blood pressure increase.

61. According to the National Library of Medicine, chronic mouth breathing can cause deformity:

Deformity in the dental arc and facial skeleton by adenoid hypertrophy due to chronic mouth breathing is a well-known process.

The analyses showed a significant increase in the anterior face height and increase in the angle between Frankfort horizontal plane-gnathion-angulus mandible and a retropositioned and posterior-rotated mandible due to thicker adenoids. **Exhibit AD.**

Wearing a mask for 7-8 hours a day forces a child to breathe through their mouth especially if they have allergies. Given this study, mask wearing can contribute to facial deformity as well.

62. CDC Ignores Research, or Lack Thereof, And Recommends Mask Mandates for Students in Schools – **See Exhibit AE.**

63. According to the Brownstone Institute, "The Damage of Masking Children Could be Irreparable.

> Visual neurology – all neurology – requires the correct or appropriate input to develop. Block the proper stimulus that would drive neural development of specific areas at a time of rapid neural growth, and development of the neural network involved is impaired.
>
> **
>
> When we surround children with mask-wearers for a year at a time, are we impairing their face barcode recognition during a period of hot neural development...... Unfortunately, the science implies that if we mess up brain development for faces, we may not currently have therapies to undo everything we've done.
>
> **
>
> Further, are mask mandates human experimentation without opportunity for informed consent by the adults and assent by the children? **See Exhibit AF.**

64. MaskScience.org links to 41 high-impact, peer-reviewed studies illustrating why masks fail to curb or reduce the spread of Covid-19, the negative effects of masking, and the adverse effects on children. **See Exhibit AG.**

65. Plaintiffs note that the state of Oregon was given $1,121,814,984 pursuant to the American Rescue Plan ("ARP") Act of 2021 by agreeing to implement the federal guidelines set forth by the CDC for COVID-19 mitigation efforts. See the attached letter from the U.S. Secretary of Education, attached hereto as **Exhibit AH**. See also, https://www2.ed.gov/documents/press-releases/arp-esser-or-plan.pdf. The letter links to the

CDC guidelines available at https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/operation-strategy.html The guidelines suggest that a school board would forfeit ARP allocations by making masks optional, and states that have prohibited mask mandates in schools have received letter notifying them that they will not receive ARP funds. Accordingly, it seems Defendants have a financial incentive for implementing the mask mandate, despite that such a requirement serves no scientific purpose and subjects individuals who wear masks to the health risks discussed above. Also, the Application Template denotes:

> 2. Safe Return to In-Person Instruction and Continuity of Services Plans: Describe how the SEA will ensure that its LEAs that receive ARP ESSER funds meet the requirements in section 2001(i) of the ARP Act and the requirements relating to the ARP ESSER funds published in the Federal Register and available at https://oese.ed.gov/offices/american-rescue-plan/american-rescue-planelementary-and-secondary-school-emergency-relief/ (***ARP ESSER requirements***) to either: (a) within 30 days of receipt of the funds, develop and make publicly available on the LEA's website a plan for the safe return to in-person instruction and continuity of services, or (b) have developed and made publicly available on the LEA's website such ***a plan that meets statutory requirements before the enactment of the ARP Act, including:***
>
> ***i. How the SEA will ensure that each LEA plan includes, or will be modified to include, the extent to which it has adopted policies and a description of any such policies on each of the strategies listed in table B1;*** **See Exhibit W.**

https://oese.ed.gov/files/2021/04/ARP-ESSER-State-Plan-Template-04-20-2021_130PM.pdf (emphasis added) **See Exhibit AI.**

66. As set forth above, violation of the constitutional rights of Petitioners as parents who are disseized and usurped of the ultimate decision making regarding the health and well-being of their children by Respondents along with the physical and emotional harm caused by wearing a mask has caused Petitioners irreparable injury and will continue to cause such injury unless and until restrained by this Court and such injury is presumed.

COUNT I - 42 U.S.C. §1983 - Violation of Procedural Due Process (5th and 14th Amendments) Against All Defendants

67. Plaintiffs incorporate the foregoing paragraphs as if set forth in full herein.

68. In order establish a claim under section 1983 of the Civil Rights Act, a plaintiff must prove a Defendant: (a) acted under the color of state law; (b) proximately causing; (c) the Plaintiff to be deprived of a federally protected right. 42 U.S.C. §1983.

69. In the instant case, Defendants unquestionably acted under the color of state law.

70. Each Individual Defendant is an elected, voting member of the North Wasco County District Board of Education with the exception of Defendant Carolyn Bernal, who is the Superintendent of the North Wasco County School District.

71. Under the Fifth Amendment to the Constitution, no person may be deprived of life, liberty, or property without due process of law. U.S. Const. Ann., Amendment V.

72. The Fourteenth applies the protections of the Fifth Amendment to state actors. U.S. Const. Ann., Amendment XIV.

73. Plaintiffs have constitutionally protected interests in the benefits that come from the not being subject to the Board's mask requirement, including the ability to pursue an education without being subjected to health risks that are not offset by any scientifically provable benefits.

74. Defendants' implementation of the mask policy unlawfully deprives Plaintiffs of these and other constitutionally-protected interests without due process of law. Such deprivation was arbitrary, capricious, based on ignorance without inquiry into facts, and in violation of the School Board's own policies and other applicable laws. Such deprivation violates the Fifth and Fourteenth Amendments of the Unites States Constitution.

75. Plaintiffs were harmed and continue to be irreparably harmed by these unlawful acts, including by suffering an overall possible simultaneous drop in oxygen saturation of the blood and increase in carbon dioxide, which contributes to an increased noradrenergic stress response, with heart rate increase and respiratory rate increase and, in some cases, a significant blood pressure increase.

COUNT II - 42 U.S.C. §1983 - Violation of Substantive Due Process (Fourteenth Amendment) – Against All Defendants

76. Plaintiffs incorporate the foregoing paragraphs as if set forth in full herein.

77. In order establish a claim under section 1983 of the Civil Rights Act, a plaintiff must prove a Defendant: (a) acted under the color of state law; (b) proximately causing; (c) the Plaintiff to be deprived of a federally protected right. 42 U.S.C. §1983.

78. In the instant case, Defendants unquestionably acted under the color of state law.

79. Each individual Defendant is an elected, voting member of the North Wasco County School District Board of Education with the exception of Defendant Carolyn Bernal, who is the Superintendent of the North Wasco County School District.

80. Under the Fourteenth Amendment to the Constitution, and as established by state law, Plaintiffs have a fundamental right to a public education and to an education in a safe and healthy environment.

81. Petitioners, as citizens of the State of Oregon, are entitled to their fundamental liberty interests as parents in making the ultimate decisions regarding the health and well-being of their children, which rights are being denied or disparaged by Respondents. These violations of the constitutional rights of Petitioners as parents who are disseized and usurped of the ultimate decision making regarding the health and well-being of their children by Respondents along with the physical and emotional harm caused by wearing a mask has caused Petitioners irreparable injury and will continue to cause such injury unless and until restrained by this Court and such injury is presumed.

COUNT III - Violation of Procedural Due Process (OR Const. Art. I, § 1 & § 10) Against All Defendants

82. Plaintiffs incorporate the foregoing paragraphs as if set forth in full herein.

83. Article 1, § 1 of the Oregon Constitution provides, "We declare that all men, when they form a social compact are equal in right: that all power is inherent in the people, and all free governments are founded on their authority, and instituted for their peace, safety, and happiness; and they have at all times a right to alter, reform, or abolish the government in such manner as they may think proper."

84. Article 1, § 10 of the Oregon Constitution provides, "No court shall be secret, but justice shall be administered, openly and without purchase, completely and without delay, and every man shall have remedy by due course of law for injury done him in his person, property, or reputation."

85. Plaintiffs have constitutionally protected interests in the benefits that come from the not being subject to the Board's mask mandate, including the ability to pursue an education without being subjected to health risks that are not offset by any scientifically provable benefits.

86. Defendants' implementation of the mask policy unlawfully deprives Plaintiffs of these and other constitutionally-protected interests without due process of law. Such deprivation was arbitrary, capricious, based on ignorance without inquiry into facts, and in violation of the School Board's own policies and other applicable laws. Such deprivation violates Article 1, § 10 of the Oregon Constitution.

87. Plaintiffs were harmed and continue to be irreparably harmed by these unlawful acts, including by suffering an overall possible simultaneous drop in oxygen saturation of the blood and increase in carbon dioxide, which contributes to an increased noradrenergic stress response, with heart rate increase and respiratory rate increase and, in some cases, a significant blood pressure increase.

COUNT IV - Violation of Substantive Due Process
(Or Const. Art. I, § 1 & § 10) Against All Defendants

88. Plaintiffs incorporate the foregoing paragraphs as if set forth in full herein.

89. Article 1, § 1 of the Oregon Constitution provides, "We declare that all men, when they form a social compact are equal in right: that all power is inherent in the people, and all free governments are founded on their authority, and instituted for their peace, safety, and happiness; and they have at all times a right to alter, reform, or abolish the government in such manner as they may think proper."

90. Article 1, § 10 of the Oregon Constitution provides, "No court shall be secret, but justice shall be administered, openly and without purchase, completely and without delay, and every man shall have remedy by due course of law for injury done him in his person, property, or reputation."

91. Under Article 1, § 10 of the Oregon Constitution, and as established by state law, Plaintiffs have a fundamental right to a public education and to an education in a safe and healthy environment.

92. Plaintiffs were harmed and continue to be irreparably harmed by these unlawful acts, including by suffering an overall possible simultaneous drop in oxygen saturation of the blood and increase in carbon dioxide, which contributes to an increased noradrenergic stress response, with heart rate increase and respiratory rate increase and, in some cases, a significant blood pressure increase.

93. I ask the courts, do we stand on the United States constitution and the principles set forth therein, is the United States Constitution simply a piece of paper that is adhered to when convenient, or is the United States Constitution in facts the supreme law of the land?

RESERVATION OF RIGHTS

Plaintiffs herein expressly reserve their rights in regards to any additional claims to which they may be entitled under federal law as well as under the laws of the State of Oregon or other actions of misconduct that may have been committed by Defendants. Plaintiffs expressly place Defendants on notice of Plaintiffs' intention to initiate removal proceedings at the state court level against Defendants as a result of the infractions Defendants have committed, as described herein.

PRAYER FOR RELIEF

WHEREFORE, Plaintiffs request that the Court grant the following relief:

a. Assume jurisdiction of this action;

b. Vacate and set aside the Defendants' mask requirement as well as any other action taken by Defendants to institute the mask requirement and implement the provisions of the mask policy;

c. Declare that the Defendants' masking policy is void and without legal force or effect;

c. Declare that the institution of the mask policy and actions taken by Defendants to implement the mask policy are arbitrary, capricious, based on ignorance due to failure to inquire into facts, otherwise not in accordance with law, and without observance of required procedures;

d. Declare that the mask policy and the actions taken by Defendants to implement the mask policy are in violation of Parental Rights, the Constitution and contrary to the laws of the United States and the State of Oregon;

e. Temporarily restrain, as well as preliminarily and permanently enjoin Defendants, their agents, servants, employees, attorneys, and all persons in active concert or participation with any of them, from implementing or enforcing the mask policy and from taking any other action to implement the masking policy that is not in compliance with applicable law; and

f. Grant such other and further relief as may be just, equitable, and proper including without limitation, an award of attorneys' fees and costs to Plaintiffs.

Respectfully submitted this ________________________.

<u>/s/ Jennifer Rae Gunter</u>
1601 G St.
The Dalles, OR 97058
(Telephone) 541-993-5366

<u>/s/ Robert Jay Schwartz ND LAC</u>
3135 Mill Creek Road
The Dalles, OR 97058
(Telephone) 541-296-8988

<u>/s/ Holly Lynn Gove</u>
421 W. 15th St
The Dalles, OR 97058
(Telephone) 541-993-4707

<u>/s/ Chelsea Elizabeth Perritt</u>
219 W. 14th Street
The Dalles, OR 97058
(Telephone) 503-437-8370

ACKNOWLEDGEMENT

Jennifer Rae Gunter

STATE OF OREGON)
) SS.
COUNTY OF WASCO)

On this 15th day of November, 2021 before me personally appeared Jennifer Rae Gunter, who being by me duly sworn did say that she is the Petitioner named in the above-captioned action an acknowledged to me that the allegations contained therein are true according to her best knowledge and belief.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my official seal in the County and State aforesaid, the day and year first above written.

OFFICIAL STAMP
TINA MARIE KIPPER
NOTARY PUBLIC - OREGON
COMMISSION NO. 997322
MY COMMISSION EXPIRES FEBRUARY 24, 2024

Tina Kipper
Notary Public

February 24, 2024
My commission Expires

ACKNOWLEDGEMENT

Robert Jay Schwartz ND LAC

STATE OF OREGON)
) SS.
COUNTY OF WASCO)

On this 15th day of November, 2021 before me personally appeared Robert Jay Schwartz ND LAC, who being by me duly sworn did say that he is the Petitioner named in the above-

captioned action an acknowledged to me that the allegations contained therein are true according to his best knowledge and belief.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my official seal in the County and State aforesaid, the day and year first above written.

OFFICIAL STAMP
TINA MARIE KIPPER
NOTARY PUBLIC - OREGON
COMMISSION NO. 997322
MY COMMISSION EXPIRES FEBRUARY 24, 2024

Tina Kipper
Notary Public

February 24, 2024
My commission Expires

ACKNOWLEDGEMENT

Holly Gove
Holly Lynn Gove

STATE OF OREGON)
) SS.
COUNTY OF WASCO)

On this 15th day of November, 2021 before me personally appeared Holly Lynn Gove, who being by me duly sworn did say that she is the Petitioner named in the above-captioned action an acknowledged to me that the allegations contained therein are true according to her best knowledge and belief.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my official seal in the County and State aforesaid, the day and year first above written.

OFFICIAL STAMP
TINA MARIE KIPPER
NOTARY PUBLIC - OREGON
COMMISSION NO. 997322
MY COMMISSION EXPIRES FEBRUARY 24, 2024

Tina Kipper
Notary Public

February 24, 2024
My commission Expires

ACKNOWLEDGEMENT

Chelsea Elizabeth Perritt

STATE OF OREGON)
) SS.
COUNTY OF WASCO)

On this 15th day of November, 2021 before me personally appeared Chelsea Elizabeth Perritt, who being by me duly sworn did say that she is the Petitioner named in the above-captioned action an acknowledged to me that the allegations contained therein are true according to her best knowledge and belief.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my official seal in the County and State aforesaid, the day and year first above written.

OFFICIAL STAMP
TINA MARIE KIPPER
NOTARY PUBLIC - OREGON
COMMISSION NO. 997322
MY COMMISSION EXPIRES FEBRUARY 24, 2024

Tina Kipper
Notary Public

February 24, 2024
My commission Expires

Exhibit A

School District 21

Board Member Oath of Office

"I, **Dawn Rasmussen**, do solemnly swear that I will support the constitution of the United States, the constitution of the state of Oregon and the laws thereof, and the policies of the North Wasco County School District. During my term, I will faithfully and impartially discharge the responsibilities of the Office of School Board Member to the best of my ability."

Signature 7/9/2019

Legal reference: ORS 332.005

Exhibit A

NWC
School District 21

Board Member Oath of Office

"I, **Jose Aparicio**, do solemnly swear that I will support the constitution of the United States, the constitution of the state of Oregon and the laws thereof, and the policies of the North Wasco County School District. During my term, I will faithfully and impartially discharge the responsibilities of the Office of School Board Member to the best of my ability."

Signature 7/9/2019

Legal reference: ORS 332.005

NWC
School District 21

Board Member Oath of Office

"I, **David Jones**, do solemnly swear that I will support the constitution of the United States, the constitution of the state of Oregon and the laws thereof, and the policies of the North Wasco County School District. During my term, I will faithfully and impartially discharge the responsibilities of the Office of School Board Member to the best of my ability."

Signature 7/9/2019

Legal reference: ORS 332.005

North Wasco County School District 21

New or Re-Elected Board Member Oath of Office

"I, **Judy Richardson**, do solemnly swear that I will support the constitution of the United States, the constitution of the state of Oregon and the laws thereof, and the policies of the North Wasco County School District. During my term, I will faithfully and impartially discharge the responsibilities of the Office of School Board Member to the best of my ability."

Legal reference: ORS 332.005

Judy Richardson
Board Member Signature

7/22/21
Date

Carolyn Bernal
Superintendent Signature

7/22/21
Date

North Wasco County School District 21

New or Re-Elected Board Member Oath of Office

"I, **Brian Stevens**, do solemnly swear that I will support the constitution of the United States, the constitution of the state of Oregon and the laws thereof, and the policies of the North Wasco County School District. During my term, I will faithfully and impartially discharge the responsibilities of the Office of School Board Member to the best of my ability."

Legal reference: ORS 332.005

Board Member Signature

7-22-21
Date

Carolyn Bernal
Superintendent Signature

7.22.21
Date

NWC School District 21

North Wasco County School District 21

New or Re-Elected Board Member Oath of Office

"I, **Rebecca Thistlethwaite**, do solemnly swear that I will support the constitution of the United States, the constitution of the state of Oregon and the laws thereof, and the policies of the North Wasco County School District. During my term, I will faithfully and impartially discharge the responsibilities of the Office of School Board Member to the best of my ability."

Legal reference: ORS 332.005

DocuSigned by:
Rebecca Thistlethwaite
77D6503CACBA490

Board Member Signature

7/26/2021

Date

Carolyn Bernal

Superintendent Signature

7/26/2021

Date

North Wasco County School District 21

New or Re-Elected Board Member Oath of Office

"I, **John Nelson**, do solemnly swear that I will support the constitution of the United States, the constitution of the state of Oregon and the laws thereof, and the policies of the North Wasco County School District. During my term, I will faithfully and impartially discharge the responsibilities of the Office of School Board Member to the best of my ability."

Legal reference: ORS 332.005

DocuSigned by:
John Nelson
233BA035A88A424

Board Member Signature

Date

Carolyn Bernal

Superintendent Signature

8·20·21

Date

Exhibit B

North Wasco County School District 21	
Code:	**KA/KAA**
Adopted:	7/24/97
Revised/Readopted:	6/23/04; 8/18/16
Orig. Code(s):	KA/KAA

District-Community Relations Goals and Objectives

The Board's goal of achieving positive school-community relations serves to:

1. Develop public understanding of all aspects of school operations, ascertain public attitudes toward issues in education and identify the public's educational expectations for their students;

2. Secure adequate financial support for the educational program;

3. Help citizens feel responsibility for the quality of education provided by their schools;

4. Earn the public's confidence with regard to school staff and services;

5. Foster public understanding of the need for constructive change and solicit public advice on achieving educational goals;

6. Involve citizens in solving educational problems;

7. Promote cooperation between the school and the community and share the leadership for improving community life.

Achieving these objectives requires that the Board and staff, individually and collectively, express positive attitudes toward the schools in their daily contacts with parents, community members and one another; make systematic, honest and continuing efforts to discover what the public thinks and what citizens want to know; interpret school programs, problems and accomplishments; develop an active partnership with the community in working toward improvement of the educational program; and take an active interest in the needs of the community to find ways to make the community a better place to live.

END OF POLICY

Legal Reference(s):

ORS 332.107

Cross Reference(s):

KBA - Public Records
KG - Community Use of District Facilities

Exhibit B

Exhibit C

North Wasco County
School District 21

Code: **BBA**
Adopted: 10/22/15

Board Powers and Duties

The Legislature of the state of Oregon delegates to the Board responsibility for the conduct and governance of programs and services in the district. The general powers granted to the Board are:

1. Legislative or Rule-Making Authority

In regular or special public meetings, after open discussion and after members' votes are recorded, the Board will establish rules or policy to govern the conduct of its members and the proceedings of the Board.

The Board shall establish policies and regulations for governing the programs and services of the district consistent with State Board of Education rules and with local, state and federal laws.

The Board is responsible for providing adequate and direct means for keeping informed about the needs and wishes of the public and for keeping local citizens informed about the schools.

2. Judicial Authority

As provided by law, policy or contract, the Board acts as a fact-finding body or a court of appeal for staff members, students and the public when issues involve Board policies or agreements and their implementation, and when the Board must determine the rights, duties or obligations of those who address the Board.

3. Executive/Administrative Authority

The Board will appoint a superintendent delegated to establish administrative regulations to implement Board policy and goals. The Board will evaluate the superintendent's performance.

The Board may establish academic and financial goals for the district and evaluate the superintendent's implementation of those goals.

The Board will oversee the district's financial affairs by authorizing, appropriating and adopting budgets and by proposing local option or bond elections, when appropriate and as allowed by law, to provide for program operation and maintenance or acquisition of district property.

The Board will authorize the superintendent to approve payment on all contracts and business transactions of the district in accordance with Board policies on purchasing and budget requirements. The Board will provide for an annual audit of the district's assets.

Exhibit C

The Board will employ the staff necessary to carry out the educational program and will provide for regular evaluation of staff.

The Board will direct the collective bargaining process to establish collective bargaining agreements with the district's personnel. The Board will establish, through the collective bargaining process where appropriate, salaries and salary schedules, other terms and conditions of employment, and personnel policies for districtwide application.

The Board will establish the days of the year and the hours of the day when school will be in session.

END OF POLICY

Legal Reference(s):

ORS 192.630
ORS 243.656
ORS Chapters 279A, 279B and 279C
ORS 294.305 to -294.565
ORS 328.205 to -328.304
ORS 332.072
ORS 332.075
ORS 332.105
ORS 332.107
ORS Chapter 339
ORS 342.805 to -342.937
ORS Chapter 343

Cross Reference(s):

DJ - District Purchasing

Exhibit D

North Wasco County
School District 21

Code: **KAB**
Adopted: 6/23/04
Revised/Readopted: 8/18/16

Parental Rights

The Board recognizes the importance of promoting parental input in decision making related to their student's health and general well-being, in determining district and student needs for educational services, in program development and district operations. To assist the district in this effort, and in accordance with the No Child Left Behind Act of 2001 (NCLBA), the district affirms the right of parents, upon request, to inspect:

1. A survey created by a third party before the survey is administered or distributed by the district to a student, including any district survey containing "covered survey items"[1] as defined by NCLBA;

2. Any instructional material used by the district as part of the educational curriculum for the student;

3. Any instrument used in the collection of personal information from students for the purpose of marketing or for selling that information or otherwise providing that information to others for that purpose.

As provided by law, parents of district students will also, upon request, be permitted to excuse their student from "covered activities"[2] as defined by NCLBA. The rights provided to parents under this policy, transfer to the student when the student turns 18 years of age, or is an emancipated minor under applicable state law.

The superintendent will ensure that activities requiring parental notification are provided as required by law and that reasonable notice of the adoption or continued use of this policy is provided to parents of students enrolled in district schools. The input of parents will be encouraged in the development, adoption and any subsequent revision of this policy.

The superintendent shall develop administrative regulations to implement this policy, including provisions as may be necessary to ensure appropriate notification to parents of their rights under federal law and

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[1]Covered survey items under NCLBA include one or more of the following items: political affiliations or beliefs of the student or the student's family; sex behavior or attitudes; illegal, antisocial, self-incriminating or demeaning behavior; critical appraisals of other individuals with whom respondents have close family relationships; legally recognized privileged or analogous relationships, such as those of lawyers, physicians and ministers; religious practices, affiliations or beliefs of the student or the student's parent; and income, other than that required by law to determine eligibility for participation in a program or for receiving financial assistance under such a program.

[2]Covered activities requiring notification under NCLBA include activities involving the collection, disclosure or use of personal information collected from students for the purpose of marketing or for selling that information or otherwise providing that information to others for that purpose; the administration of any survey containing one or more of covered survey items; and any nonemergency, invasive physical examination or screening that is required as a condition of attendance and administered and scheduled by the school in advance. See the administrative regulation for additional definitions.

Exhibit D

district procedures to request review of covered materials, excuse a student from participating in covered activities and protect student privacy in the event of administration or distribution of a survey to a student.

END OF POLICY

Legal Reference(s):

ORS 332.107

Protection of Pupil Rights, 20 U.S.C. § 1232h (2006); Student Rights in Research, Experimental Programs and Testing, 34 C.F.R. Part 98 (2006).

Exhibit E

North Wasco County
School District 21

Code: **JF/JFA**
Adopted: 3/02/17

Student Rights and Responsibilities**

The Board has the responsibility to afford students the rights that are theirs by virtue of guarantees offered under federal and state constitutions and statutes. In connection with these rights are responsibilities that must be assumed by students.

Among these student rights and responsibilities are the following:

1. Civil rights — including the rights to equal educational opportunity and freedom from discrimination; the responsibility not to discriminate against others;

2. The right to attend free public schools; the responsibility to attend school regularly and to observe school rules essential for permitting others to learn at school;

3. The right to due process of law with respect to suspension, expulsion and decisions which the student believes injure his/her rights;

4. The right to free inquiry and expression; the responsibility to observe reasonable rules regarding these rights;

5. The right to privacy, which includes privacy with respect to the student's education records.

Students have the right to know the behavior standards expected of them as well as to know the consequences of misbehavior.

Students' rights and responsibilities, including standards of conduct, will be made available to students, their parents and employees through information distributed annually.

END OF POLICY

Legal Reference(s):

ORS 332.061
ORS 332.072
ORS 337.150
ORS 339.155

ORS 339.240
ORS 339.250
ORS 659.850
ORS 659.865

OAR 581-021-0045
OAR 581-021-0046
OAR 581-021-0050 to -0075
OAR 581-022-1140

Hazelwood Sch. District v. Kuhlmeier, 484 U.S. 260 (1988).
Bethel Sch. Dist. v. Fraser, 478 U.S. 675 (1986).

Cross Reference(s):

JFC - Student Conduct

Exhibit E

Exhibit F

North Wasco County School District 21

Code: BBF
Adopted: 1/14/04
Revised/Readopted: 10/25/07; 10/22/15; 8/27/20

Board Member Standards of Conduct

A Board member should:

1. Comply with ethics laws for public officials;
2. Understand that the Board sets the standards for the district through Board policy. Board members do not manage the district on a day-to-day basis;
3. Attend all regularly scheduled Board meetings insofar as possible and become informed concerning the issues to be considered at those meetings;
4. Understand that the Board makes decisions by a quorum vote of the Board. Individual Board members may not commit the Board to any action;
5. Recognize that policy decisions must be made only after full discussion at publicly held Board meetings;
6. Respect the right of other Board members to have opinions and ideas which differ;
7. Recognize that decisions made by a quorum vote are the final decisions of the Board. Such decisions should be supported by all Board members;
8. Make decisions only after the facts are presented and discussed;
9. Understand the chain of command and refer problems or complaints directly to the superintendent unless the complaint is against the superintendent which should be referred to the Board chair on behalf of the Board;
10. Recognize that the Board must comply with the Public Meetings Law and only has authority to make decisions at properly noticed Board meetings;
11. Insist that all Board and district business is ethical and honest;
12. Be open, fair and honest — no hidden agendas;
13. Understand that Board members will receive information that is confidential and cannot be shared;
14. Recognize that the superintendent is the Board's employee and designated as the chief executive officer of the district;
15. Take action only after hearing the superintendent's recommendations;
16. Refuse to bring personal or family problems into Board considerations;

Exhibit F

17. Give district staff the respect and consideration due to skilled, professional employees;
18. Present personal criticism of district operations to the superintendent, when appropriate, not to district staff;
19. Respect the right of the public to attend and observe Board meetings;
20. Respect the right of the public to be informed about district decisions and school operations as allowed by law;
21. Remember that content discussed in executive session is confidential;
22. Use social media, websites, or other electronic communication judiciously, respectfully, and in a manner that does not violate Oregon's Public Meetings Laws and follows School Board Policies JFCEB: Personal Electronic Devices and Social Media and Policy GCAB: Personal Electronic Devices and Social Media;
23. When posting online or to social media, Board members will treat and refer to other Board members, staff, students and the public with respect, and will not post confidential information about students, staff or district business and follows School Board Policies JFCEB: Personal Electronic Devices and Social Media and Policy GCAB: Personal Electronic Devices and Social Media;
24. A Board member is a mandatory reporter of child abuse. A Board member having reasonable cause to believe that any child with whom the Board member comes in contact with has suffered abuse or that any person with whom the Board member comes in contact with has abused a child shall immediately make an oral report by telephone or otherwise to the local Department of Human Services (DHS), to the designee of the department or to a local law enforcement within the county where the person making the report is located at the time of contact;
25. Remember always the first and greatest concern of the board must be the educational welfare of the students attending the public schools.

END OF POLICY

Legal Reference(s):

ORS 162.015 - 162.035
ORS 162.405 - 162.425
ORS 192.610 - 192.710
ORS 244.040
ORS Chapter 244
ORS 332.055
ORS 419B.005
ORS 419B.010
ORS 419B.015
Senate Bill 415 (2019)

Cross Reference(s):

BBFA - Board Member Ethics and Conflicts of Interest
GBI - Gifts and Solicitations

Exhibit G

North Wasco County School District 21	
Code:	**JFCA**
Adopted:	4/12/01
Revised/Readopted:	6/09/04; 3/02/17
Orig. Code(s):	JFCA

Student Dress and Grooming**

Responsibility for dress and grooming rests primarily with students and their parents. However, the district expects student dress and grooming to meet standards which ensure that the following conditions do not exist:

1. Disruption or interference with the classroom learning environment;

2. Threat to the health and/or safety of the student concerned or of other students.

Students who represent the school in a voluntary activity may be required to conform to dress and grooming standards and may be denied the opportunity to participate if those standards are not met.

Building principals are responsible for identifying and enforcing specific building dress codes. The superintendent will ensure that building dress codes are coordinated.

END OF POLICY

Legal Reference(s):

ORS 339.240
ORS 339.250

OAR 581-021-0050 to -0075

Exhibit G

Exhibit H

North Wasco County School District 21

Code: JFCF
Adopted: 12/10/09
Revised/Readopted: 4/14/11; 6/16/16; 8/22/19
Orig. Code: JFCF

Hazing/Harassment/Intimidation/Bullying/Menacing/Cyberbullying/ Teen Dating Violence, or Domestic Violence – Student

The Board, in its commitment to providing a safe positive, and productive learning environment for all students, will consult with parents/guardians, employee, volunteers, students, administrators, and community representatives in developing this policy in compliance with applicable Oregon law.

Hazing, harassment, intimidation, menacing or bullying and acts of cyberbullying by students, staff, or third parties towards students is strictly prohibited. Teen dating violence is unacceptable behavior and prohibited.

Retaliation against any person who is a victim of, who reports, is thought to have reported, or files a complaint about an act of hazing, harassment, intimidation, bullying, menacing, an act of cyberbullying, or teen dating violence, or otherwise participates in an investigation or inquiry is strictly prohibited. False charges shall also be regarded as a serious offense and will result in consequences and appropriate remedial action.

Students whose behavior is found to be in violation of this policy will be subject to consequences and appropriate remedial action which may include discipline, up to and including expulsion. The district may also file a request with the Oregon Department of Transportation to suspend the driving privileges or the right to apply for driving privileges of a student 15 years of age or older who has been suspended or expelled at least twice for assaulting or menacing another student or employee, willful damage or injury to district property or for the use of threats, bullying, intimidation, harassment, or coercion against a district employee or another student.

Staff whose behavior is found to be in violation of this policy will be subject to consequences and appropriate remedial action which may include discipline, up to and including dismissal. Third parties who behavior is found to be in violation of this policy shall be subject to appropriate sanctions as determined and imposed by the superintendent or the Board.

Students, staff, or third parties may also be referred to law enforcement officials.

The principal and the superintendent is responsible for ensuring that this policy is implemented.

Definitions

"District" includes district facilities, district premises, and nondistrict property if the student is at any district-sponsored, district-approved, or district-related activity or function, such as field trips or athletic events where students are under the jurisdiction of the district.

"Third parties" include, but are not limited to, coaches, school volunteers, parents, school visitors, service contractors, or others engaged in district business, such as employees of businesses or organizations

Exhibit H

participating in cooperative work programs with the district and others not directly subject to district control at interdistrict and intradistrict athletic competitions or other school events.

"Hazing" includes, but is not limited to, any act that recklessly or intentionally endangers the mental health, physical health or safety of a student for the purpose of initiation or as a condition or precondition of attaining membership in, or affiliation with, any district-sponsored activity or grade level attainment, (i.e., personal servitude, sexual stimulation/sexual assault, forced consumption of any drink, alcoholic beverage, drug or controlled substance, forced exposure to the elements, forced prolonged exclusion from social contact, sleep deprivation or any other forced activity that could adversely affect the mental or physical health or safety of a student); requires, encourages, authorizes or permits another to be subject to wearing or carrying any obscene or physically burdensome article; or assignment of pranks to be performed or other such activities intended to degrade or humiliate. It is not a defense against hazing that the student subjected to hazing, consented to or appeared to consent to the hazing.

"Harassment, intimidation or bullying" means any act that substantially interferes with a student's educational benefits, opportunities or performance, that takes place on or immediately adjacent to district grounds, at any district-sponsored activity, on district-provided transportation, or at any official district bus stop, that may be based on, but not limited to, the protected class status of a person, having the effect of:

1. Physically harming a student or damaging a student's property;
2. Knowingly placing a student in reasonable fear of physical harm to the student or damage to the student's property; or
3. Creating a hostile educational environment including interfering with the psychological well-being of the student.

"Protected class" means a group of persons distinguished, or perceived to be distinguished, by race, color, religion, sex, sexual orientation[1], national origin, marital status, familial status, source of income, or disability.

"Teen dating violence" means:

1. A pattern of behavior in which a person uses or threatens to use physical, mental, or emotional abuse to control another person who is in a dating relationship with the person, where one or both persons are 13 to 19 years of age; or
2. Behavior by which a person uses or threatens to use sexual violence against another person who is in a dating relationship with the person, where one or both persons are 13 to 19 years of age.

"Cyberbullying" is the use of any electronic communication device to harass, intimidate or bully. Students and staff will refrain from using personal communication devices or district property to harass or stalk another.

"Domestic violence" means abuse between family and/or household members, as those terms are described in ORS 107.705.

[1]"Sexual orientation" means an individual's actual or perceived heterosexuality, homosexuality, bisexuality or gender identity, regardless of whether the individual's gender identity, appearance, expression or behaviors differs from that traditionally associated with the individual's sex at birth.

"Retaliation" means any acts of, including but not limited to, hazing, harassment, intimidation or bullying, menacing, or cyberbullying toward the victim, a person in response to an actual or apparent reporting or participation in the investigation of, hazing, harassment, intimidation, menacing, bullying, teen dating violence, acts of cyberbullying, or retaliation.

"Menacing" includes, but is not limited to, any act intended to place a district employee, student, or third party in fear of imminent serious physical injury.

Reporting

The Building principals will take reports and conduct a prompt investigation of any reported acts of hazing, harassment, intimidation or bullying, menacing, teen dating violence and acts of cyberbullying. Any employee who has knowledge of conduct in violation of this policy shall immediately report concerns to the superintendent who has overall responsibility for all investigations. Any employee who has knowledge of incidents of teen dating violence that took place on district property, at a district-sponsored activity, or in a district vehicle or vehicle used for district-provided transportation shall immediately report the incident to the superintendent. Failure of an employee to report any act of hazing, harassment, intimidation or bullying, menacing teen dating violence or an act of cyberbullying to the superintendent may be subject to remedial action, up to and including dismissal. Remedial action may not be based solely on an anonymous report.

Any student who has knowledge of conduct in violation of this policy or feels they have been subjected to an act of hazing, harassment, intimidation or bullying, menacing, or cyberbullying or feel they have been a victim of teen dating violence in violation of this policy, is encouraged to immediately report concerns to the superintendent who has overall responsibility for all investigations. Any volunteer who has knowledge of conduct in violation of this policy is encouraged to immediately report concerns to the building principal or superintendent who has overall responsibility for all investigation.

A report made by a student or volunteer may be made anonymously. A student or volunteer may also report concerns to a teacher or counselor who will be responsible for notifying the appropriate district official.

Reports against the principal shall be filed with the superintendent. Reports against the superintendent shall be filed with the Board chair.

The person who makes the report shall be notified when the investigation has been completed and, as appropriate, the findings of the investigation and any ~~that~~ remedial action that has been taken. The person who made the report may request that the superintendent review the actions taken in the initial investigation, in accordance with district complaint procedures.

Training and education

The district is encouraged to incorporate into existing training programs for students, information related to the prevention of, and the appropriate response to, acts of harassment, intimidation or bullying, and acts of cyberbullying and this policy.

The district shall incorporate age-appropriate education about teen dating violence and domestic violence into new or existing training programs for students in grade 7 through 12.

The district shall incorporate into existing training programs for staff information related to the prevention of, and the appropriate response to, acts of harassment, intimidation or bullying, teen dating violence, domestic violence, and acts of cyberbullying and this policy.

Notice

The superintendent shall be responsible for ensuring annual notice of this policy is provided in a student or staff handbook, school and district's website, and school and district office. Complaint procedures, as established by the district, shall be followed.

Domestic violence posters provided by the Oregon Department of Education (ODE) shall be posted in clearly visible locations on school campuses in accordance with rules adopted by ODE.

END OF POLICY

Legal Reference(s):

ORS 163.190
ORS 166.065
ORS 166.155 to -166.165
ORS 174.100(7)
ORS 332.072
ORS 332.107
ORS 339.240
ORS 339.250
ORS 339.254
ORS 339.351 to -339.366
OAR 581-021-0045
OAR 581-021-0046
OAR 581-021-0055
OAR 581-022-1140

Title VI of the Civil Rights Act of 1964, 42 U.S.C. § 2000d (2006).

Cross Reference(s):

GBN/JBA - Sexual Harassment
JBA/GBN - Sexual Harassment
JFCM - Threats of Violence

Exhibit I

Special School Board Meeting

Thursday, August 12, 2021 6:00 PM
@northwascoschools

1. **Call the Special School Meeting to Order** — **Presenter:** Jose Aparicio, Chair

2. **Public Listening Session**

Going back to school can be a time of anxiety, excitement and opportunity for students, families, teachers and staff. This fall, as students in North Wasco County School District 21 return to full-time, in-person learning, we are creating safe spaces that promote health, safety, care, connection and fun in the classroom.

The North Wasco County School District Board of Directors and District Leadership will be hosting a Community "Listening Session" for families, staff and community members to speak in person, comment via Zoom webinar or submit written comments about reopening schools to in-person / full time learning.

To attend the Special Board Meeting in person - the following protocols are required while in the building:

- Masks / face coverings are required to be worn at all times
- Chairs will be spaced appropriately (6 ft apart) to maintain socially distanced
- Sign in contact tracing log will be available and all participants must sign in

To sign up to speak, there will be a Speaker sign-in form at the meeting to complete. ***Comments will follow District Policy, with up to 3 minutes per person for comments.***

To sign up to speak via Zoom, please contact Cindy Miller at millerc@nwasco.k12.or.us - to receive a Zoom webinar link and added to the speaker list. Please make sure your first and last name is on your Zoom profile, so we are able to admit you into the presentation room. ***Comments will follow District Policy, with up to 3 minutes per person for comments.*** *Deadline to sign up to speak via Zoom is Wednesday, August 11th by 5:00 PM.*

To submit written comments to be read out loud at the meeting, please email those to Cindy Miller at millerc@nwasco.or.us, *no later than Wednesday, August 11th by 5:00 PM.*

Exhibit I

North Wasco County School District School Board Meetings are available to view as follows:

- D21 Facebook Page: @northwascoschools
- D21 YouTube Channel: https://www.youtube.com/channel/UCGY-11Qun8oEMWC2XJ4998w

3.

4. Adjourn the Special School Board Meeting

Exhibit J

North Wasco County School District 21
School Board Work Session Meeting
6:00 PM

August 19th, 2021

Virtual Meeting and limited Board Members onsite

Mission Statement

"Graduating all students to be college and career ready; challenging, inspiring, and empowering them to be healthy and productive citizens."

Minutes

(These minutes have been approved by the Board)

Board Members Present Virtual: Rebecca Thistlethwaite, Dawn Rasmussen, Jason Corey

Board Members Present In-person: Judy Richardson, John Nelson, David Jones, Jose Aparicio, Brian Stevens

Staff and Audience Present & Virtual: Dr. Carolyn Bernal, Cindy Miller, Sandy Harris, Julie Gurzcynsky, Theresa Peters, Ajay Rundell, Carol Dowsett, Kurt Evans, Phil Williams, Billy Brost, Kara Flath, Scott Whitbeck, Brian Schimel, Dottie Ray, Amy Hampton, Lisa Kaseberg, Alex Dimare

1. **Call the Board Work Session to Order.**

Chair Aparicio called the board work session to order at 6:00 PM.

2. **District Mission / Vision Statement.**

Director Richardson read the Mission and Vision Statement.

3. **Reopening Schools Presentation: *Safe Return to In-person instruction & Continuity of Services Plan.***

District Administration reviewed the draft Safe Return to In-person Instruction and Continuity of Services Plan that will be required to be in place prior to school starting. *((The presentation document will be included in the approved minutes.))*

4. **Public Comments Submitted:**

Submitted public comments were read by Chair Aparicio. Written comments will be included in the August 19th, 2021 approved minutes.

Exhibit J

In-person comments:

Brandy Narry *- parent at Chenowith Elementary School: Ms. Narry stated that people are responsibility to maintain their own health and our government should respect an individual decision. She is frustrated that the government is telling parents how to their raise children and if they don't follow the rules, then they will be punished (health decisions). She noted that it should be the parent and/or child's decision to wear a mask, as the school district's responsibility is to teach children about individualism.*

Jodi Ketchum, Sylvia Brock, Sharlene Bonham *– D21 EA and NWESP (Presidents): Ms. Ketchum, Ms. Brock and Ms. Bonham thanked the school board for hiring Dr. Bernal, and noted that they appreciate Dr. Bernal's open door policy, willingness to problem solve and willingness to be upfront on what she can and cannot control. They thanked the school board for holding these open listening meetings and being transparent and open to concerns and questions from staff and parents. Ms. Ketchum asked if the school board had any questions from the survey submitted last week or any other concerns. Ms. Ketchum stated that staff are happy to have students in person, but concerned about sick leave for staff and/or their families, will be asking the district to reinstate the hybrid/CDL former agreements in the event the school will need to close down so these are in place.*

Tara Donivan *– community member: Ms. Donivan stated she is concerned about mental health issues being pushed aside this last year, and need to be addressed. She stated that masks are not normal and are not healthy for kids, both mentally and physically. Masks are making kids scared and intimidated, making them afraid of everything. Ms. Donivan noted that suicide and/or self-harm is increasing and very high in teens. She stated that the mental health of kids should be more of a concern than the virus. Ms. Donivan shared some studies & data on suicides, and noted that mental health issues directly correlate with kids wearing masks. Ms. Donivan asked why are we punishing the kids by making them wear masks, and noted that the board and administrators will be held accountable if mental health concerns are not addressed. Ms. Donivan stated that she does not agree with our government and they do not care about our health. Ms. Donivan stated that the board is willing to risk kids health with hybrid learning, online learning and wearing masks. She stated that she does not agree with the Governor's recent statement about "wearing a mask is an act of kindness". She stated that this is pathetic and if we need a mask to teach our kids kindness, then we're doing something wrong. Ms. Donivan stated that kids need to stay in sports and should not have to wear a mask. She stated that this virus is not going away, but the school district continues to use excuses to use online learning/hybrid learning and wearing a mask as good for kids. She noted that other schools in the area are fighting to keep the choice for parents to mask or not their kids, and this should be up to parents if the child is masked or not. The school district's responsibility is to educate our kids, not decide what is best for their health. This is a parent's decision.*

JR Runyon – PE teacher at Dry Hollow*: Mr. Runyon agreed with Mr. Conklin who spoke last week. He stated that his is pro-in person learning and not having kids wear masks. He noted that it is hard to breathe in mask while doing physical education, and noted he has a hard time talking in his mask. He stated that he 'dumbs down' his physical education curriculum to help kids participate. He also noted that PE activities did not work in CDL or hybrid – as online does not work for everyone. Mr. Runyon noted that the district should give parents the option of masking or not for their children and parents should not send their kids to school if they are sick. Mr. Runyon stated that it is difficult for kids to get the exercise they need with a mask and he's seeing many kids gaining weight because of online learning because they are behind a computer and not being active. He stated that to build up immunity is by exercising but can't do with a mask on. Mr. Runyon stated that he has a strong opinion against mandatory vaccinations. He also noted that if he knew he would be forced to be vaccinated, he would have considered a different career path. He doesn't believe the government should force people to get vaccinated. He thanked the school board for listening. He believes the vaccination gave his spouse heart issues and problems, doesn't know the long term effects and doesn't understand how the government can force teachers to get the vaccines. ((Mr. Runyon*

shared this information later in the meeting: shared that both his wife and himself were intimated and forced into getting the vaccine for a medical procedure, and his wife now has heart issues. He stated that this is not a coincidence, and he would not have gotten the vaccine if he wasn't forced, scared or intimated into getting it.))

Meghan McAllister – parent: *Ms. McAllister thanked everyone for taking health and safety in this community very seriously. She stated that she would like the district to think 'outside the box' this year with looking at possibly outdoor school and other options for kids.*

Jennifer Gunter - parent: *Ms. Gutner noted that originally wanted to comment about masks and the negative impact on mental and emotional health in children and D21's protocol and effects for a virus that is here to stay, however, with the announcement today by our complete tyrannical Governor mandating vaccination for all K-12 educators, she feels grief for district staff and children. She would like to strongly encourage District 21 teachers to band together for their medical freedoms, for themselves and their colleagues, there will never be just this time for any health mandate. Every time you give into health care that is experimental and no long term data, you are showing acceptance and compliance. The power grabs will get worse and farther reaching. This vaccine is not approved and does not have long term data. Ms. Gunter stated that we are being persecuted into submission against their own free will and people should be able to make their own decision. Ms. Gunter stated she does not agree with vaccinations available on district property and disagrees with kids being able to make their own medical decision. She stated that the school should not take part in allowing a vaccination clinic on school grounds with bribing kids with cash prizes, pizza, music, fun and activities to get the vaccination. The district should take no part in promoting a vaccine that not approved, but only is only authorized on a trial basis. The school board has decided to let the kids be told to 'muzzled' and support medical mandates that have no place in society. Covid-19 poses little to no risk on our children, and very little children have died. The flu has had more deaths than Covid-19. Board members have not suggested a daily vitamin or practices for natural immune support, but instead offers a sugary start every day. Ms. Gunter restated that medical mandates have no place in a free society. ((shared later in the meeting: Would like clarification on visual screening? Who decides this? What does this look like? Do families have a choice to stay home if immunocompromised? Is the school going to allow a student council member into the teacher's lounge to make sure they are following the rule?))*

Benjamin Warren – community member: *Mr. Warren stated that mitigation strategies would be implemented, such as wearing a mask and social distancing, but noted his concern and disagreement with small cohorts. He asked the board what metrics would the district be using to evaluate these strategies. What is the criteria? Is there criteria? Is the board relying only on the CDC? Mr. Warren stated that over several years has had several jobs, he's seen several traits of failing organizations – which are: unclear policies, impossible goals and obsession with safety. He noted that an impossible goal would be shielding or preventing all transmissions of a virus. Obsessed safety may include ignoring every other factor – such as not balancing safety with other factors that are needed to be safe. There is a cost to all the policies that are being implemented, kids are growing up isolated with their heads in phones. Mr. Warren stated that policies and criteria need to be shared publically, so community members know that the board and staff are not 'moving the goal posts' behind closed doors, it is very easy to hide the failure and create our own data. Mr. Warren stated that we cannot let the school district fail – this fails kids to become adults.*

Sarah McCanna: *Ms. McCanna would like to know how the masks are going to be enforced at school during the school day? ((Chair Aparicio asked that questions be directed to Dr. Bernal by email for responses)). Ms. McCanna also stated that at the middle and high school there may be some kids not wanting to comply. She would like to know what punishment will be given to students who do not wear masks? Ms. McCanna also asked what each board members has done to be a voice for parents and kids, to fight for families to allow the parents/children to have a choice.*

Lindsay LeBreton – community member: *Ms. LeBreton read a letter from Horizon Christian School's Elementary Principal. Ms. LeBreton chose to enroll her students last year in private school and is going to going again register them again in private school this year, as they will not have to mask during school hours. Ms. LeBreton asked the school board to look at using clear masks so kids can see staff speak.*

Chair Aparicio thanked the many speakers tonight as this is helpful to hear different perspectives. He clarified the difference between board policies (found on the district's website) and Oregon Administrative Rules / Oregon Revised Statutes. He noted that the recent state statues the district is following is state law, and are required to follow these. Part of the school board oath is to follow the law. The school board does not have the option to not follow state law. Chair Aparicio stated he has been on several state committees that allows him to advocate and share feedback from staff, parents and community members about their opinions and perspective with State law makers.

5. **Discussion / Action Items**:

    a. **Action Item**: ***Approve Authorization of Additional Contract Amount for Kurtz Gym Seismic Rehabilitation Project.***

Motion by Director Nelson, seconded by Director Stevens, to approve the budget for capital improvements for the Kurtz Gym Seismic Project in the additional amount $300,000 from the enterprise funds, totaling $2,420,080; and to authorize the increase in contract amount for the existing GMP contract with Griffin Construction, LLC. Motion Passed Unanimously.

6. **Adjourn the Regular School Board Meeting.**

Chair Aparicio adjourned the board work session at 8:00 PM.

Jose Aparicio, Chair

Dr. Carolyn Bernal, Superintendent

Cindy Miller

Cindy Miller, Recorder

Exhibit K

North Wasco County School District 21
Regular School Board Meeting
6:00 PM

August 26th, 2021

Mission Statement
"Graduating all students to be college and career ready; challenging, inspiring, and empowering them to be healthy and productive citizens."

Minutes
(These minutes have been approved by the Board)

Board Members Present Virtual: Rebecca Thistlethwaite, Dawn Rasmussen

Board Members Present In-person: Judy Richardson, John Nelson, David Jones, Jose Aparicio, Brian Stevens

Staff and Audience Present & Virtual: Dr. Carolyn Bernal, Kara Flath, Cindy Miller, Jason Corey

Chair Aparicio read the following statement:

1. **Call the Regular School Board Meeting to Order.**

Chair Aparicio called the regular meeting to order at 6:00 PM and led the audience in the pledge of allegiance.

2. **District Vision & Mission Statement**

Chair Stevens read the District Vision & Mission Statement.

3. **Student / Staff Recognition:**

Dr. Bernal recognized Zora Richardson, who was awarded the Distinguished Young Women for Wasco County and the State of Oregon.

Brian Schimel, Human Resources, presented new staff to North Wasco County SD along with staff who have transferred to other school buildings.

Exhibit K

4. <u>Public Comments Submitted:</u>

David Bandel - parent: Mr. Bandel expressed his and his family's appreciation for the mask mandate, he feels children are resilient and kids will get through this. He stated that Colonel Wright staff are doing the right thing and years later they will know they did the right thing. Mr. Bandel stated that the school board and his comments are probably not going to change any minds, but wanted to let the board know his thoughts.

Andrea Dorzab - parent: Ms. Dorzab noted she is concerned with the lack of advocacy for students and is upset that she feels the D21 board is not advocating for students and families. She stated that district 21 has not sent a survey out asking parents their feedback around students wearing masks and the board should gather input from parents. Ms. Dorzab stated at the last meeting, it was stated that the mask mandate was an OAR and nothing could be done about it, however, she disagrees. She noted that the school board could gather feedback from parents and community members and give that feed back to the Governor and OHA, as she feels these agencies are overreaching their authority and taken away local decision making. Ms. Dorzab stated that local tax payers are funding the schools, so it's their voices that should be heard. Ms. Dorzab would like to know how equity is not being used, reviewed some data from OHA about hospitalizations and deaths, and stated she disagrees with staff members being required to be vaccinated. This is not helpful as many school districts will see a staffing shortage. She noted that children are at a low risk for this disease, and we should stop the nonsense, stop trying to control it. Ms. Dorzab stated that equity is for everyone, not just those who you agree with.

Jennifer Gunter - parent: Ms. Gunter thanked the board for the extra time last week to speak. Ms. Gunter stated that the district 21 school board has chosen to make students wear masks. She noted that the board should bring in an environmental toxicologist/industrial hygienist to have all of classrooms air tested. She noted that the results will show what masks are needed, and that state mask mandates do not work against viral or bacterial infections. Real science, and what the law describes as respiratory infections and procedures, do not justify the d21 board arbitrary power in using these mandates and violating children's civil liberties. Ms. Gunter stated that she is not aware of any board members who are certified environmental toxicologist or industrial hygienist, and no air quality testing has been conducted in our school district. Ms. Gunter feels like the school board actions has violated the US Constitution and school board's oath. Ms. Gunter urged the school board without haste, to act on completing an air quality test and provide results and/or further testing scheduled to the community. Ms. Gunter would like know where the school board's letter pushing back against the mask and vaccine mandate it, and would also like a survey to be sent out to families.

Emma Pieris – medical doctor: Dr. Pieris stated she is a primary care physician, and a parent of 2 students. She thanked the school board, administrators and teachers for everything they have done during the pandemic. Dr. Pieris stated that she agrees students do much better with in person learning, and strongly supports the mask mandate and vaccination to those eligible. She noted that covid-19 is a public health and safety issue like we've never seen before. She stated that this is not something that can be controlled by only some people following the recommendations. As a health care provider she is familiar with answering questions about information that sounds scientific on the internet, but doesn't stand up to more rigorous scientific research. Dr. Pieris stated that while some information on the internet can be true and helpful, she has never seen the amount of mistrust on this issue. She believes a lot of this is tied up not in the science, but rather advertisers who benefit from us drawing a line in the sand and then experiencing a righteous fury when confronted with the other side. Dr. Pieris stated that when we come together as individuals and as a community with shared concerns for our loved ones, that doing the right thing should be easy.

Paul Cardosi – medical doctor: Dr. Cardosi is an internal medicine physician (sleep clinic) and noted that he spends the majority of his time analyzing oxygen and carbon dioxide levels in the Sleep Clinic, and for the last year wearing a mask. Dr. Cardosi agrees with Dr. Pieris's comments with the level of misinformation, and some extremely false, and has never seen this level in society. He noted that masks are likely to reduce the transmission of corona virus, they may not be 100% effective, but evidence shows they are partially effective. He noted that the rate of

transmission with the delta variant is rapidly increasing (2 or 3 times more likely to be transmitted to another person). Dr. Cardosi stated that the health of a student is important and so is the health of their families. He noted that family members who are exposed and quarantined cannot go to work. Dr. Cardosi stated that the majority of ICU beds are filled with unvaccinated people. He receives this information from his colleagues at OSHU who are specialists in the health care field, and in Europe. Hospitals are being overrun and beds are not available for those situations outside of covid-19 related cases, such as car accidents or medical issues not related to covid-19. Dr. Cardosi stated that many nurses and doctors are not able to work due to being sick, which is a concern because medical care cannot be given if hospitals are understaffed. He also noted that first responders may not be able to work (fire & police) as well our teachers. He noted that yes, masks can be uncomfortable, hot and sometimes he gets short of breath – however – we need to work to minimize this virus as quickly as possible.

Phil Brady - Chairman of Board of Trustees of MCMC: Mr. Brady stated that making decisions should be made in the best interest of the public, and he understands that the school board is constrained by several factors and boards have very little areas to maneuver. MCMC is working hard to keep staff and families healthy in our community, but when hospitals are crowded and cannot care for the public, this is concerning. MCMC will continue to be good partners with the school district and support in any way.

Jane Corboy – family doctor: Dr. Corboy stated that she would like to touch on three areas: communication skills, equity and community caring for one another and public safety. Dr. Corboy has many years of experience working with kids and was worried that they would not be able to communicate well with her while wearing a mask. She noted in her experience, kids have not had an issue with communicating with her, and have learned to communicate well even with wearing masks. Dr. Corboy stated that in person learning is critical for our students and be able to keep them safe. She thanked the school board making every attempt to make school safe for students. Dr. Corboy stated that Wasco County is at an extreme level with the virus infection, which many families are still being affected and cannot go to work. The more infected in our community, the higher risk of exposure to a more extreme virus than delta.

Rob Schwartz – local physician: Mr. Schwartz noted that physician means 'teacher of health', not healer. He noted that Covid is not going anywhere and will never be eliminated; it will be less infectious to us over time. He noted that the average death age of covid is 81 years; with the average life span, age is 77. Physicians should be teaching people how to be healthy, to eat correctly and exercise. People who are not aged but debilitated are people who are obese as this is a serious issue in the world. Mr. Schwartz stated that masks should not continue to be used, but an alternative to masks would be to wear face shields. Mr. Schwartz noted that medicine has not always had the right answer, and doctors should think about what is being stated, and not just the research you see, as the research will change. Mr. Schwartz stated that to keep our population healthy is to teach them how to stay healthy and don't scare people.

Luke Webb – ER physician: Dr. Webb stated masks are somewhat effective to alleviate the spread of the disease, and a lot of bad information is being circulated. It is important that medical specialists speak up and set the record straight. Dr. Webb stated that people deserve to be happy, healthy and to live long lives. He stated that covid 19 isn't a death sentence for everyone, but wearing a mask and getting the vaccine will help protect yourself from this disease. Dr. Webb stated that students need to be in school and learning in person, and wearing masks is the easiest, safest way to accomplish this.

David Cleveland – family medicine physician: Dr. Cleveland stated he is a father of 2 students and a physician in family medicine. He stated he truly appreciates the board's dedication to the safety of students and staff. He noted that his own children have been wearing masks to school for the last year and are tired of it – but they understand the importance of wearing a mask and keeping people safe. Dr. Cleveland stated his students are not (nor have) had issues with breathing, or carbon dioxide increased levels with wearing a mask. His experience during the pandemic in the hospital has unfortunately been difficult to watch people die and have difficulty breathing when it could have

been prevented by wearing a mask and vaccinating. Dr. Cleveland stated he supports the school board's decision to require masks.

Sarah McCaffrey - pediatrician: Dr. McCaffrey thanked the school board for their dedication. She noted that the American Pediatrics Association & Oregon Pediatrics Society supports the mask mandates at school by the OHA. Dr. McCaffrey stated that it is important to not be distracted but focus on the data: 90% of 2 year olds in Oregon have received their childhood immunizations; 63% of all Oregon citizens have had at least one dose of the covid vaccine; 69% adults in the US support school mask mandates. Dr. McCaffrey read an article from the Physician Chief at the Dornbeckers Children's Hospital and Chief Medical Officer at OHSU.

Jennifer Morrison - pediatrician: Dr. Morison is a local pediatrician and stated the importance of students having in person learning this year. She stated that depression is very high in our kids because their social support has been removed. We now have multiple tools we can use to keep kids in school this year as long as we follow safety procedures and mitigation strategies. Dr. Morrison noted that she has seen more positive covid kids in the last couple of weeks than in the last year, as this virus is now more dangerous than ever before. She strongly supports the mask mandate in the school district and encourages families to get vaccinated. Dr. Morrison thanked the board for their service.

Analene Pentopoulos - OBGYN: Dr. Pentopoulos is local physician and has 2 students currently in school. She noted that we are learning more about covid 19 and research is continually changing – which can be frustrating and confusing. However, in the last 15 months, the science & data have been clear – masks can keep people safe as long as other safety measures (physical distancing, washing hands, stay home when sick, vaccination [if available], etc.) are followed. Students can be in school safety if protocols are followed, as masks protect those wearing the masks as well as those around the person wearing a mask. It only works as long as masks and safety protocols are worn by all. This is not about personal preference or choice; this is about the health and safety of our community. Wearing a mask protects our family, friends and community members. Dr. Pentopoulos stated that masks do not cause harm, as surgeons have been wearing masks for years, long before covid.

Reverend Kirk Quinlivan: Rev Quinlivan stated everything that is said this evening will be moot as the board will bow to the State when they shut down the schools in the next few weeks. He stated he is not an anti-vaccine person. He stated that many should be concerned about covid-19, but no one is mandating healthy eating, sit-ups, or vitamin D. Rev Quinlivan stated he and his family are supporters of the public schools and volunteers regularly. However, is he violently opposed to anyone being forced to take a medical treatment that they are coerced under the threat of their jobs. How will the board staff the schools when teachers are sick and cannot come to work with no substitutes available? Rev Quinlivan stated that if the school board cannot be trusted to care for the values of people different from the board, then he could not trust his children to the school board and staff's care. He noted he is upset that the district only announced today that an online academy option will be available, and a survey was not sent out to parents/families asking their voice about masks. He stated that he has unenrolled his student from the district and will be homeschooling him this year.

Kristy Hansen – community member: Ms. Hansen stated that she was born and raised in this community and wants her students to raised in a community where people help one another. She noted that there has been a lot of conflicting information, fear, emotion and personal opinions voiced this year last. She stated that students need to be in school, and noted that removing parental decisions about if their student wears a mask or not, is not healthy. Ms. Hansen stated that the school board implementing the mask mandate is unconstitutional, that no medical mandate in a free society is appropriate and teachers deserve the right to decide what is best for them. Ms. Hansen stated she would like to know when the questions are going to be answered that has been asked in the public meetings and would like to see a survey go out to parents about masks.

Lindy Kuehnl – community member: Ms. Kuehnl stated she is against the mask mandate for both kids and adults, and is very against a vaccine mandate for staff in North Wasco. She would like to know D21's liability status for staff

in the event of side effects caused by the vaccine. Ms. Kuehl noted that masks are dangerous for children and reviewed some data about masks being detrimental. She stated that the mandated vaccination is unnecessary and asked who is going to volunteer for an experimental vaccine.

Colin McInnes – Psychiatric Nurse Practitioner: Dr. McInnes noted that noted a lot of misinformation has been and currently being spread around, but from his recent experience with talking to students, they want to be back in school with their friends and to see their teachers. He stated that in order to do this safety and keep schools open, the schools need to wear masks and continue to implement and follow the recommended health and safety measures. Dr. McInnes stated that the job as a parent and caregivers of this community is to take care of each other.

Written comments submitted:

Kathleen Wilder (attached to these minutes)

Dr. Mimi McDonnell (attached to these minutes)

5. **Consent Agenda**

Items B & C were pulled from the agenda and will be included in the September 23rd, 2021 agenda.

Motion by Director Nelson, seconded by Director Richardson, to approve the consent agenda as amended (add Dr. Bernal's powerpoint presentation). Motion Passed Unanimously.

6. **Board Action Calendar – Review**

Chair Aparicio reviewed the Board Action Calendar for both August and Sept.

7. **School Board Sub Committee Reports**

- **D21 Education Foundation:** Director Thistlethwaite reported that the Education Foundation Board members met recently and announced their fall fundraiser (help support classroom mini-grants) will be a movie hosted at SunShine Mill. Director Thistlethewaite stated that our community could purchase tickets for the drive in movie with 39 spots available. Director Thistlethwaite stated that the Ed Foundation would be releasing requests for proposals next week to staff – up to $500 for classroom projects.

- **Community Outreach Team:** *No report at this time.*

- **Wellness Committee:** *No report at this time.*

- **Building/Facilities Report:** *No report at this time.*

- **District Equity Committee:** No report at this time.

- **D21 Scholarship Meeting:** No report at this time.

- **Wasco County Forest Collaborative:** No report at this time.

8. **New Business:**

   a. **Presentations / Reports:**

      1. **Superintendent's Report**

Dr. Bernal reported administrative staff are busy preparing for school to open on Monday and Tuesday, and all staff are being welcomed back this week with professional development trainings and building in-services. Dr. Bernal reported that the Safe Return to In Person Instruction and Continuity of Instruction Plan is due to ODE tomorrow, which information included this year is very different from last year's blueprints. She noted that staff is finalizing the district's communicable diseases plan and once completed, this plan will be available on the district's website.

Chair Aparicio stated he is looking forward to having kids in the building again full time, and is excited to walk his son to school on the first day. Supt Bernal noted the priority and goal is to keep the schools open to in person learning while keeping staff and students safe.

Director Thistlethwaite asked about what is happening with online learning and is there an option this year? Supt Bernal reported that online learning would be an option for students who are immunocompromised (or who may have family members) or have a medical accommodation, and will be using the Acellus K-12 program. She noted that staff will be working on building up the online program by adding synchronous work; however, at this time the priority for staff is to get the program started and students enrolled.

Director Richardson stated she is looking forward to in person learning and would like to hear more from students in the future about how they are enjoying school, what's school like for them this year, and how are they doing wearing masks. Dr. Bernal noted that one of her goals is to implement a student roundtable and would like to bring the students voice to the board.

Dr. Bernal reported on the Oregon English Language Learner State Report prepared by the Oregon Department of Education, which is now available for the public to review. This report is available on the ODE website, as well as on the NWCSD website and hard copies in the district office. Dr. Bernal noted the purpose of her report tonight is to announce the annual report is available to review and that the report is specifically statewide information on English Language Learners, but does not include specific information about D21 students or programs.

      2. **Chief Financial Officer's Report**

Kara Flath noted that the information included in the board packet is not final as of yet, as revenue is continuing to be collected differently this year. Ms. Flath is anticipating more funding from property tax collections, as this funding is coming in slowly. She presented the board summary report and reported on the summer school enrollment and a summer program recap.

Director Thistlethwaite thanked staff for doing a good job and having a successful summer school, and to staff who participated even when they really needed a good long summer break.

Director Rasmussen stated that she appreciates the amount of financial information shared by Ms. Flath, as her reports include more depth and detailed information.

Director Stevens stated he had the opportunity to visit the summer program at the Columbia Gorge Discovery Center, and would like to continue these types of programs every summer as they are very successful and important for our students. He would also like to see the District continue our partnership with the Discovery Center. Director Stevens thanked Ms. Flath for putting this program together.

Chair Aparicio thanked staff for their efforts implementing the summer programs and thanked all involved who staffed these programs. Chair Aparicio asked about ESSER III funding and what was the intention of these funds? Ms. Flath reported that all of the ESSER funding is required to be used for pandemic related issues: learning loss, learning recovery and economic loss.

3. **Board Attorney's Report**

Mr. Corey reminded staff that if any subpoenas are sent to them to report to court, to please contact him first so he can help support staff with their rights and responsibilities.

9. **Discussion / Action Items:**

   a. **Action Item: Approve the Riverbend Community School Charter Agreement as recommended.**

Dr. Bernal, Kara Flath, Brian Schimel and Amy Hampton met with Riverbend CS staff to review the recommended charter agreement, and the following revisions were agreed upon and included in the document this evening:

- Some changes to nutritional services language, adding the ability to adjust charter funds language and financial reporting date's language.

Director Thistlethwaite asked about math instruction, as it looks like this area will now be going through the online Acellus program. She would like to know what the plan is moving forward. Dr. Bernal will get this information and let her know.

Director Thistlethwaite asked about fundraising in their budget, and what is the plan for this? Discussed increased fundraising this year as this is a concern and will need to be completed.

Director Thistlethwaite asked about the Farm to School Grant and if this grant is sustainable? She noted that some grants are pass through funding and are allowed to be used in only specific ways, and because of this, there is a concern with sustainability.

Kara Flath noted that several discussions with Riverbend CS staff were held around their charter being financially stable, and staff are aware that true sustainable funding centers around a higher enrollment, and so this is a focus area they are working.

Director Nelson stated that he is concerned about their financial sustainability and what has staff done to improve this? Ms. Flath noted that a good discussion was held around sustainable funding, and staff understand that funding comes down to increased enrollment. They have improved their branding and are working very hard to get enrollment up. Ms. Flath stated the board requested to allow Riverbend CS to implement a 3-year commitment plan for repaying some funding, and she is hopeful that their strategies will work and this payment plan will also help. Director Nelson stated he is also concerned with the amount of staff versus the student enrollment, and is

wondering if revisions to staffing have been revised to fit more within their budget. Ms. Flath noted that Riverbend CS staff have updated their staffing to reflect this.

Director Stevens stated that the board is voting tonight on approving a 3-year contract, but if numbers fall below the stated enrollment, what happens? Ms. Flath noted that if Riverbend CS is not financial viable and cannot continue to maintain the stated enrollment, then the charter would not be able to continue and the district would have to make some changes. Director Stevens asked what would happen to the students if the charter were dissolved? Ms. Flath noted that the district has several alternative programs available and a lot of staff with expertise in this area, so staff would come up with additional options.

Chair Aparicio stated that section 11 of the agreement includes several scenarios and "what if's" that may happen, and so both parties would then follow the strategies outlined in this section. The reporting requirements that Ms. Flath has built in to the agreement should help support the current plan with the district being able to monitor appropriately.

Director Stevens asked if the board should possibly look at going with a 1 year or 2 year contract instead of a 3 year contract. Ms. Flath noted that the district and charter staff would need to renegotiate sooner with a year or two agreement. She noted that a lot of good discussions were held between district staff and Riverbend staff, and she felt the 3-year agreement is appropriate.

Director Thistlethwaite noted that having a longer contract helps with receiving grants for sustainability. This is important for receiving awards.

Director Rasmussen noted that the board should think about what kind of message is being sent to students to not back up their education, as many discussions/negotiations with staff have been held and by approving the agreement, it shows a good faith effort to the students.

Director Thistlethwaite asked if the board could postpone this decision for another meeting, as she feels conflicted without the Riverbend CS Executive Director available to answer questions. Chair Aparicio stated that this decision has already been extended by 2 months, and needs to have a decision tonight.

Chair Aparicio stated the board should remember we have all been in a pandemic and safe guards are included in this agreement for this purpose. He is in favor of this agreement as recommended moving forward.

Motion by Director Rasmussen, seconded by Director Nelson, to approve the Riverbend Community School Agreement valid from September 1st, 2021, through June 30th, 2024. Yes: Nelson, Richardson, Jones, Aparicio, Rasmussen, Thistlethwaite Abstained: Stevens. Motion Passed.

b. **<u>Action Item</u>: Re-adopt the District calendar for the 2021-2022 school year as presented.**

Dr. Bernal reported that a holiday was passed into law recently and school districts are required to be closed on legal holidays, so the district calendar will need to reflect this. She noted that this holiday is in late June, so it does not affect the student contact days.

Motion by Director Richardson, seconded by Director Jones, to approve the revised 2021-2022 school district calendar as recommended. Motion Passed Unanimously.

10. Adjourn the Regular School Board Meeting.

Chair Aparicio adjourned the regular school board meeting at 8:15 PM.

Jose Aparicio

Jose Aparicio, Chair

Carolyn Bernal

Dr. Carolyn Bernal, Superintendent

Cindy Miller

Cindy Miller, Recorder

August 26, 2021

The D 21 school board has decided to force children to wear a mask based on "science" without any sound legal qualification to my knowledge.

This state mandate assumes that the school air quality is hazardous to our children's health and therefore prescribed a mask citing "science".

Please refer to the federal statute below:
29 CFR § 1910.134 - Respiratory protection
https://www.law.cornell.edu/cfr/text/29/1910.134

The actual science would have been that the state of Oregon and or District 21 actually conducted an air quality test. That would consist of bringing in an Environmental Toxicologist/industrial hygienist to do air sampling during D21 classes.

That Environmental Toxicologist would then determine if masks and what masks are exactly needed.

All Environmental Toxicologist will tell you that masks and face coverings that States mandate do not work against viral or bacterial infections.

Real science and what the law describes as respiratory protection and procedures do not justify the district 21 school board arbitrary power in issuing these mandates and violating children civil liberties.

No one on the board to my knowledge is a certified environmental toxicologist/ or an industrial hygienist and no air quality testing has been conducted within our district.

The school board's actions are an attempt to demonstrate dominion over civil liberties in violation of the US Constitution, and the school board oath.

I urge you without haste to act on my request for an investigation and proposal of intervention into Oregon state mandates that claim "science".

I would like this school district to provide those tests and the information concluded from such test and if such testing is yet planned?

Regards,
Jennifer Gunter

Exhibit L

10-7-2021
To all concerned,
D21 district board. Statements and questions as follows,

Over the past 9-weeks, community members have asked numerous questions that have been ignored and have gone unanswered by D21 board members even though they have been repeatedly asked at multiple board meetings. I am requesting, as others before me have, for the verifiable data and studies that deemed our school should remain masked.

All I can see is the district benefit for the ESSR funding. The funding requirement is to follow local, state and federal law which is an unconstitutional emergency executive order mandated guideline which seems to fall under the terms of conditions of "masking to receive funding" which is not based on science but monetary gain and which is compelling our district into unlawful acts..

1.) Please supply information that was used to require masking for our area of demographics to make a collective decision as a district prior to school opening, besides "our hands are tied statements" that violates people's rights to their own heath decisions and minors liberty.

Parents have not been shown or presented with creative solutions, just a cookie cutter summary that was supplied and shown to surrounding districts seemingly all the same.

A survey was never presented to involve parents for such creative solutions, and or to volunteer their time and resources to the district.

2.) A survey was submitted ONLY to teachers from a head teacher representative. Excluding parental participation. A survey was not nor ever been offered from the district. (If such survey exists for parents, please show me where I can find the parent feedback that I may have missed or the email sent to participate in such survey for the back to school masking opinions.)

With that said, as a board you collectively decided to move forward with choosing to mask the district children and staff as well as implementing a new district wide policy of masking for competitive sports regardless of OHA and OSAA guideline. Taking recommendations and only consulting with a local heath dept. official and NOT the parents who hold ultimate responsibility of authority over their Child's healthcare decisions is unacceptable.

Oregon sports statewide is abiding by OHA and OSAA guidelines. A very select few schools are implementing masks for their athletes outside of those. Concerning and raising brows as the consulted Wasco heath official attended their own child's competitive sports event at the college of their unmasked athlete. I will give benefit of doubt that their opinion about masking has since changed by being able to participate in such a free maskless manor. Or maybe official has new insight from their daughter's experience competing maskless in such a large state while traveling. This is totally opposite of the local health department advice for our personal children.

Exhibit L

3.) Deschutes County, Redmond school Board has hired legal aid to oppose this overreach of power against Governor Kate Brown and not leaving these decisions to a local level based on geography, demographics and parental input. Will our district consider this legal representation option without haste?

School is for educating basic requirements to graduate at grade level 12. D21 parents and children have NOT collectively checked into a heath care facility to have medical decisions made for them by their local schools.

We now approach homecoming and it seems based on a staff zoom call you are partnering with the local health Dept. ONCE AGAIN to impose healthcare decisions that should remain within the family, let alone how ridiculous it is your requiring and or considering only un-vaccinated attendees supply a negative Covid test. This is the utmost ABSURD thing I have heard thus far, beside the ploys to minors of soliciting for social gatherings of food and prizes to get a vaccine that is a total private choice within their family in an extremely venerable time when families where isolated and most struggling to provide food and interactions for their children. It is simply solicitation to minors by the school and health dept. in lure of children so healthcare can meet county vaccination quotas.

FACT, I personally know one of MCMC first Covid patients who tested positive on February 19th 2020, then recovered and STILL tested positive for COVID up to April 6th 2020.

4.) What is your plan for unvaccinated children testing positive after recovery when it is a known fact a person can test positive for many months. What is the course of action taken for children already recovered from COVID that may test a false positive to attend homecoming?

FACT, people can contract and spread Covid even when vaccinated. That has been proven more every day. No matter how "rare" the heath dept. likes to pass it off as, it is still factual.

So with that said you are segregating and discriminating by not requiring a vaccinated attendee to supply the exact same negative test as well. Seems a little risky that a negative test of an Unvaccinated attendee could "contract Covid" from a **vaccinated** attendee that supplied no test to prove they are not sick as well! Lack of equity is apparent here based on the adoption of such buzz words within the district.

Let me be clear regardless of how much you consult the heath dept. you're still an educational 'structure' or system of core educational basic study subjects based in educational learning. The school district is not a healthcare system, healthcare facility, or has authority by claiming executive extended arbitrary power decided by the district for healthcare practices to exclude parental consent and only implementing heat dept. suggestions.

5.) I specifically would like to know directly by what authority does the board have to overpower parental choices to compel healthcare acts and non-medical devices for minor children?

6.) When will my request for a certified industrial hygienist test be conducted?

7.) As a Wasco County resident I require you all to uphold your duties by the sworn oath of your positions supporting our State and federal constitution. Such oath that you willfully took that was formed at our countries foundation. That has since afforded you all the liberty and freedom to hold office that you have been elected into by our county taxpayers. Will all you uphold the constitutional rights for your district school attendees?

8.) See attached docs. from case matter expert that is based in science and facts on PPE, masking and reply with how this does not apply to our districts directly when deciding masking policy?

I respectfully state my expectation for answers to all questions above 1-8 are required within one weeks' time 10/15/2021.

Regards,
Jennifer Gunter

As of October 5 2021 according to the OHA state wide,
Total Cases 336,598
Total Deaths 3,867

<20 years old
Cases=60,615
Hospitalized=524 (footnote by OHA was not all were admitted but "seen")
Deaths=5 (comorbidity, existing illness, terminally ill all pending review)
Percent of total deaths 5/3,867 =0.129%
Survival Rate 5/60615 =99.992%
Hospitalization 524/60615=0.865%

Data collected since March of 2020, 18 months.

North Wasco County School District 21
Information Request Response to letter from Jennifer Gunter (Received October 7, 2021)

October 15, 2021

1. **Please supply information that was used to require masking for our area of demographics to make a collective decision as a district prior to school opening, besides "our hands are tied statements" that violates people's rights to their own heath decisions and minors liberty.**

   OAR 333-019-1015 (attached for your reference)
   Ready Schools, Safe Learners Resiliency Framework for the 2021-2022 School Year (attached for your reference)

2. **A survey was submitted ONLY to teachers from a head teacher representative. Excluding parental participation. A survey was not nor ever been offered from the district. (If such survey exists for parents, please show me where I can find the parent feedback that I may have missed or the email sent to participate in such survey for the back to school masking opinions.)**

   There was no requirement for school districts to survey parents to solicit opinions related to masks as they are currently a requirement under OAR 333-019-1015.

   The survey you are referring to was conducted by the OEA not D21.

3. **Deschutes County, Redmond school Board has hired legal aid to oppose this overreach of power against Governor Kate Brown and not leaving these decisions to a local level based on geography, demographics and parental input. Will our district consider this legal representation option without haste?**

   No, the District is not considering this.

4. **What is your plan for unvaccinated children testing positive after recovery when it is a known fact a person can test positive for many months. What is the course of action taken for children already recovered from COVID that may test a false positive to attend homecoming?**

   The only requirement for students who attend the high school dance will be to wear a mask.

5. **I specifically would like to know directly by what authority does the board have to overpower parental choices to compel healthcare acts and non-medical devices for minor children?**

   If you are referring to the requirement of students wearing masks, the board has this authority under OAR 333-019-1015 (attached for your reference).

6. **When will my request for a certified industrial hygienist test be conducted?**

   The District will not be conducting this test.

7. **As a Wasco County resident I require you all to uphold your duties by the sworn oath of your positions supporting our State and federal constitution. Such oath that you willfully took that was formed at our countries foundation. That has since afforded you all the liberty and freedom to hold office that you have been elected into by our county taxpayers. Will all you uphold the constitutional rights for your district school attendees?**

   As superintendent, I do not take a sworn oath. In the board members' oath of office they promise to uphold the Constitutions of the United States and Oregon, and the laws thereof, as well as the District's policies. They are doing so by following the directives of OAR 333-019-1015.

8. **See attached docs. from case matter expert that is based in science and facts on PPE, masking and reply with how this does not apply to our districts directly when deciding masking policy?**

   The district is following and will continue to follow OAR 333-019-1015 (attached for your reference) and the guidelines provided in the Ready Schools, Safe Learners Resiliency Framework for the 2021-2022 School Year (attached for your reference).

   As these guidelines are updated and/or changes are made, the district will also update and/or make changes accordingly.

Centers for Disease Control and Prevention

Exhibit M

COVID-19

UPDATE

Given new evidence on the B.1.617.2 (Delta) variant, CDC has updated the guidance for fully vaccinated people. CDC recommends universal indoor masking for all teachers, staff, students, and visitors to K-12 schools, regardless of vaccination status. Children should return to full-time in-person learning in the fall with layered prevention strategies in place.

Guidance for COVID-19 Prevention in K-12 Schools

Updated Oct. 22, 2021 Print

Key Takeaways

- Students benefit from in-person learning, and safely returning to in-person instruction in the fall 2021 is a priority.
- Vaccination is the leading public health prevention strategy to end the COVID-19 pandemic. Promoting vaccination can help schools safely return to in-person learning as well as extracurricular activities and sports.
- Due to the circulating and highly contagious Delta variant, CDC recommends universal indoor masking by all students (age 2 and older), staff, teachers, and visitors to K-12 schools, regardless of vaccination status.
- In addition to universal indoor masking, CDC recommends schools maintain at least 3 feet of physical distance between students within classrooms to reduce transmission risk. When it is not possible to maintain a physical distance of at least 3 feet, such as when schools cannot fully re-open while maintaining these distances, it is especially important to layer multiple other prevention strategies, such as screening testing.
- Screening testing, ventilation, handwashing and respiratory etiquette, staying home when sick and getting tested, contact tracing in combination with quarantine and isolation, and cleaning and disinfection are also important layers of prevention to keep schools safe.
- Students, teachers, and staff should stay home when they have signs of any infectious illness and be referred to their healthcare provider for testing and care.
- Many schools serve children under the age of 12 who are not eligible for vaccination at this time. Therefore, this guidance emphasizes implementing layered prevention strategies (e.g., using multiple prevention strategies together consistently) to protect students, teachers, staff, visitors, and other members of their households and support in-person learning.
- Localities should monitor community transmission, vaccination coverage, screening testing, and occurrence of outbreaks to guide decisions on the level of layered prevention strategies (e.g., physical distancing, screening testing).

Summary of Recent Changes

Updates as of October 22, 2021

Updated recommendation for fully vaccinated people who have a known exposure to someone with suspected or confirmed COVID-19 to be tested 5-7 days after exposure, regardless of whether they have symptoms.

Exhibit M

Updates as of August 4, 2021

- Updated to recommend universal indoor masking for all students, staff, teachers, and visitors to K-12 schools, regardless of vaccination status.
- Added recommendation for fully vaccinated people who have a known exposure to someone with suspected or confirmed COVID-19 to be tested 3-5 days after exposure, regardless of whether they have symptoms.

Updates as of July 9, 2021

- Added information on offering and promoting COVID-19 vaccination.
- Updated to emphasize the need for localities to monitor community transmission, vaccination coverage, screening testing, and occurrence of outbreaks to guide decisions on the level of layered prevention strategies.
- Revised to emphasize the COVID-19 prevention strategies most important for in-person learning for K-12 schools.
  - Added language on the importance of offering in-person learning, regardless of whether all of the prevention strategies can be implemented at the school.
  - For example, because of the importance of in-person learning, schools where not everyone is fully vaccinated should implement physical distancing to the extent possible within their structures (in addition to masking and other prevention strategies), but should not exclude students from in-person learning to keep a minimum distance requirement.
- Updated to align with guidance for fully vaccinated people.
- Updated to align with current mask guidance.
  - In general, people do not need to wear masks when outdoors.
- Added language on safety and health protections for workers in K-12 schools.

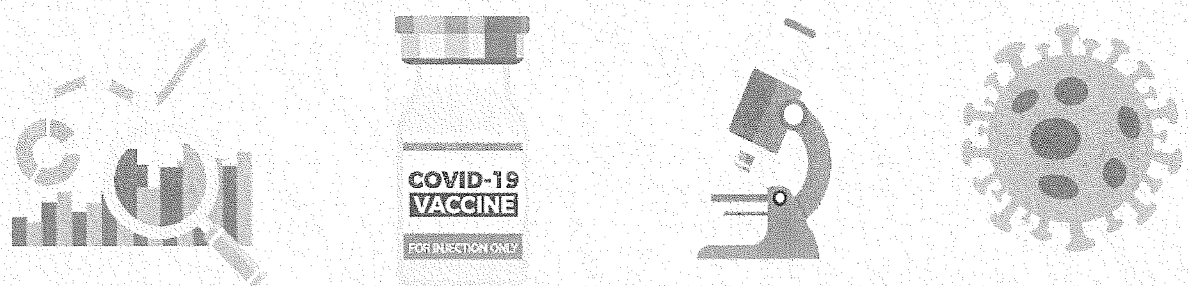
This updated version of COVID-19 guidance for school administrators outlines strategies for K-12 schools to reduce the spread of COVID-19 and maintain safe operations.

Many schools serve children under the age of 12 who are not eligible for vaccination at this time. Therefore, this guidance emphasizes implementing layered prevention strategies (e.g., using multiple prevention strategies together) to protect students, teachers, staff, and other members of their households, and to support in-person learning. This guidance is based on current scientific evidence and lessons learned from schools implementing COVID-19 prevention strategies.

This CDC guidance is meant to supplement—not replace—any federal, state, local, territorial, or tribal health and safety laws, rules, and regulations with which schools must comply. The adoption and implementation of this guidance should be done in collaboration with regulatory agencies and state, local, territorial, and tribal public health departments, and in compliance with state and local policies and practices.

COVID-19 Prevention Strategies Most Important for Safe In-Person Learning in K-12 Schools

To get kids back in-person safely, schools should monitor



Community Transmission

Vaccination Coverage

Testing

Outbreaks

to help prevent the spread of COVID-19

cdc.gov/coronavirus

CS325431A 07/06/2021

Schools are an important part of the infrastructure of communities. They provide safe and supportive learning environments for students that support social and emotional development, provide access to critical services, and improve life outcomes. They also employ people, and enable parents, guardians, and caregivers to work. Though COVID-19 outbreaks have occurred in school settings, multiple studies have shown that transmission rates within school settings, when multiple prevention strategies are in place, are typically lower than – or similar to – community transmission levels. CDC's science brief on Transmission of SARS-CoV-2 in K-12 Schools and Early Care and Education Programs summarizes evidence on COVID-19 among children and adolescents and what is known about preventing transmission in schools and Early Care and Education programs.

However, with COVID-19 cases increasing nationally since mid-June 2021, driven by the B.1.617.2 (Delta) variant of SARS-CoV-2, protection against exposure remains essential in school settings. Because of the highly transmissible nature of this variant, along with the extent of mixing of vaccinated and unvaccinated people in schools, the fact that children <12 years of age are not currently eligible for vaccination, and low levels of vaccination among youth ages 12-17, CDC recommends universal indoor masking for all students (age 2 years and older), teachers, staff, and visitors to K-12 schools regardless of vaccination status.

Schools should work with local public health officials, consistent with applicable laws and regulations, including those related to privacy, to determine the additional prevention strategies needed in their area by monitoring levels of community transmission (i.e., low, moderate, substantial, or high) and local vaccine coverage, and use of screening testing to detect cases in K-12 schools. For example, with a low teacher, staff, or student vaccination rate, and without a screening testing program, schools might decide that they need to continue to maximize physical distancing or implement screening testing in addition to mask wearing.

Schools should communicate their strategies and any changes in plans to teachers, staff, and families, and directly to older students, using accessible materials and communication channels, in a language and at a literacy level that teachers, staff, students, and families understand.

Health Equity

Schools play critical roles in promoting equity in learning and health, particularly for groups disproportionately affected by COVID-19. People living in rural areas, people with disabilities, immigrants, and people who identify as American Indian/Alaska Native, Black or African American, and Hispanic or Latino have been disproportionately affected by COVID-19; these disparities have also emerged among children. For these reasons, health equity considerations related to the K-12 setting are a critical part of decision-making and have been considered in CDC's updated guidance for schools. School administrators and public health officials can ensure safe and supportive environments and reassure families, teachers, and staff by planning and using comprehensive prevention strategies for in-person learning and communicating those efforts. Schools can work with parents to understand their preferences and concerns for in-person learning.

School administrators can promote health equity by ensuring all students, teachers, and staff have resources to support physical and mental health. School administrators can offer modified job responsibilities for staff at higher risk for severe illness who have not been fully vaccinated while protecting individual privacy. Federal and state disability laws may require an individualized approach for working with children and youth with disabilities consistent with the child's Individualized Family Service Plan (IFSP), Individualized Education Program (IEP), or Section 504 plan. Administrators should consider adaptations and alternatives to prevention strategies when serving people with disabilities, while maintaining efforts to protect all children and staff from COVID-19.

Section 1: Prevention Strategies to Reduce Transmission of SARS-CoV-2 in Schools

CDC recommends that all teachers, staff and eligible students be vaccinated as soon as possible. However, schools have a mixed population of both people who are fully vaccinated and people who are not fully vaccinated. Elementary schools primarily serve children under 12 years of age who are not eligible for the COVID-19 vaccine at this time. Other schools (e.g., middle schools, K-8 schools) may also have students who are not yet eligible for COVID-19 vaccination. Some schools (e.g., high schools) may have a low percentage of students and staff fully vaccinated despite vaccine eligibility. These variations

require K-12 administrators to make decisions about the use of COVID-19 prevention strategies in their schools and are reasons why CDC recommends universal indoor masking regardless of vaccination status at all levels of community transmission.

Together with local public health officials, school administrators should consider multiple factors when they make decisions about implementing layered prevention strategies against COVID-19. Since schools typically serve their surrounding communities, decisions should be based on the school population, families and students served, as well as their communities. The primary factors to consider include:

- Level of community transmission of COVID-19.
- COVID-19 vaccination coverage in the community and among students, teachers, and staff.
- Strain on health system capacity for the community.
- Use of a frequent SARS-CoV-2 screening testing program for students, teachers, and staff who are not fully vaccinated. Testing provides an important layer of prevention, particularly in areas with substantial to high community transmission levels.
- COVID-19 outbreaks or increasing trends in the school or surrounding community.
- Ages of children served by K-12 schools and the associated social and behavioral factors that may affect risk of transmission and the feasibility of different prevention strategies.

Prevention Strategies

- Promoting vaccination
- Consistent and correct mask use
- Physical distancing
- Screening testing to promptly identify cases, clusters, and outbreaks
- Ventilation
- Handwashing and respiratory etiquette
- Staying home when sick and getting tested
- Contact tracing, in combination with isolation and quarantine
- Cleaning and disinfection

CDC recommends universal indoor masking, physical distancing to the extent possible, and additional prevention strategies to protect students, teachers, and staff. Schools should not exclude students from in-person learning to keep a minimum distance requirement; layering multiple prevention strategies is essential when physical distancing of at least 3 feet is not possible at all times.

1. Promoting Vaccination

COVID-19 vaccination among all eligible students as well as teachers, staff, and household members is the most critical strategy to help schools safely resume full operations.

Vaccination is the leading public health prevention strategy to end the COVID-19 pandemic. People who are fully vaccinated against COVID-19 are at low risk of symptomatic or severe infection. A growing body of evidence suggests that people who are fully vaccinated against COVID-19 are less likely to become infected and develop symptoms and are at substantially reduced risk from severe illness and death from COVID-19 compared with unvaccinated people.

Only a small proportion of fully vaccinated people get infected (breakthrough infections), even with the Delta variant. Moreover, when these infections occur among vaccinated people, they tend to be milder than among those who are unvaccinated. However, preliminary evidence suggests that fully vaccinated people who are infected with the Delta variant can be infectious and can spread the virus to others. To reduce the risk of becoming infected with the Delta variant and spreading it to others, students, teachers, and school staff should continue to use layered prevention strategies including universal masking in schools.

People 12 years and older are now eligible for COVID-19 vaccination. Schools can promote vaccinations among teachers, staff, families, and eligible students by providing information about COVID-19 vaccination, encouraging vaccine trust and confidence, and establishing supportive policies and practices that make getting vaccinated as easy and convenient as possible.

When promoting COVID-19 vaccination, consider that certain communities and groups have been disproportionately affected by COVID-19 illness and severe outcomes, and some communities might have experiences that affect their trust and confidence in the healthcare system. Teachers, staff, students, and their families may differ in their level of vaccine confidence. School administrators can adjust their messages to the needs of their families and community and involve trusted community messengers as appropriate, including those on social media, to promote COVID-19 vaccination among people who may be hesitant to receive it.

To promote vaccination, schools can:

- Visit vaccines.gov to find out where teachers, staff, students, and their families can get vaccinated against COVID-19 in the community and promote COVID-19 vaccination locations near schools.
- Encourage teachers, staff, and families, including extended family members that have frequent contact with students, to get vaccinated as soon as they can.
- Consider partnering with state or local public health authorities to serve as COVID-19 vaccination sites, and work with local healthcare providers and organizations, including school-based health centers. Offering vaccines on-site before, during, and after the school day and during summer months can potentially decrease barriers to getting vaccinated against COVID-19. Identify other potential barriers that may be unique to the workforce and implement policies and practices to address them. The Workplace Vaccination Program has information for employers on recommended policies and practices for encouraging COVID-19 vaccination uptake among workers.
- Find ways to adapt key messages to help families, teachers, and staff become more confident about the vaccine by using the language, tone, and format that fits the needs of the community and is responsive to concerns.
- Use CDC COVID-19 Vaccination Toolkits to educate members of the school community and promote COVID-19 vaccination. CDC's Workers COVID-19 Vaccine Toolkit is also available to help employers educate their workers about COVID-19 vaccines, raise awareness about vaccination benefits, and address common questions and concerns. HHS also has an On-site Vaccination Clinic Toolkit to help community groups, employers, and other host organizations work directly with vaccine providers to set up vaccination clinics in locations that people know and trust.
- Host information sessions to connect parents and guardians with information about the COVID-19 vaccine. Teachers, staff, and health professionals can be trusted sources to explain the safety, efficacy, and benefits of COVID-19 vaccines and answer frequently asked questions.
- Offer flexible, supportive sick leave options (e.g., paid sick leave) for employees to get vaccinated or who have side effects after vaccination. See CDC's Post-vaccination Considerations for Workplaces.
- Promote vaccination information for parents and guardians, siblings who are eligible for vaccines, and other household members as part of kindergarten transition and enrollment in summer activities for families entering the school system.
- Provide students and families flexible options for excused absence to receive a COVID-19 vaccination and for possible side effects after vaccination.
- Work with local partners to offer COVID-19 vaccination for eligible students and eligible family members during pre-sport/extracurricular activity summer physicals.

2. Consistent and Correct Mask Use

When teachers, staff, and students consistently and correctly wear a mask, they protect others as well as themselves. Consistent and correct mask use is especially important indoors and in crowded settings, when physical distancing cannot be maintained.

- **Indoors**: CDC recommends indoor masking for all individuals age 2 years and older, including students, teachers, staff, and visitors, regardless of vaccination status.
- **Outdoors**: In general, people do not need to wear masks when outdoors. CDC recommends that people who are not fully vaccinated wear a mask in crowded outdoor settings or during activities that involve sustained close contact with other people. Fully vaccinated people might choose to wear a mask in crowded outdoor settings if they or someone in their household is immunocompromised.

Exceptions can be made for the following categories of people:

- A person who cannot wear a mask, or cannot safely wear a mask, because of a disability as defined by the Americans with Disabilities Act (ADA) (42 U.S.C. 12101 et seq.). Discuss the possibility of reasonable accommodation with workers who are unable to wear or have difficulty wearing certain types of masks because of a disability.
- A person for whom wearing a mask would create a risk to workplace health, safety, or job duty as determined by the relevant workplace safety guidelines or federal regulations.

Masks should meet one of the following criteria:

- CDC mask recommendations
- NIOSH Workplace Performance and Workplace Performance Plus masks

During school transportation: CDC's Order applies to all public transportation conveyances including school buses. Passengers and drivers must wear a mask on school buses, including on buses operated by public and private school systems, regardless of vaccination status, subject to the exclusions and exemptions in CDC's Order. Learn more here.

Schools should provide masks to those students who need them (including on buses), such as students who forgot to bring their mask or whose families are unable to afford them. No disciplinary action should be taken against a student who does not have a mask as described in the U.S. Department of Education COVID-19 Handbook, Volume 1 .

3. Physical Distancing

Because of the importance of in-person learning, schools should implement physical distancing to the extent possible within their structures but should not exclude students from in-person learning to keep a minimum distance requirement. In general, CDC recommends people who are not fully vaccinated maintain physical distance of at least 6 feet from other people who are not in their household. However, several studies from the 2020-2021 school year show low COVID-19 transmission levels among students in schools that had less than 6 feet of physical distance when the school implemented and layered other prevention strategies, such as the use of masks.

Based on studies from 2020-2021 school year, CDC recommends schools maintain at least 3 feet of physical distance between students within classrooms, combined with indoor mask wearing to reduce transmission risk. When it is not possible to maintain a physical distance of at least 3 feet, such as when schools cannot fully re-open while maintaining these distances, it is especially important to layer multiple other prevention strategies, such as screening testing, cohorting, improved ventilation, handwashing and covering coughs and sneezes, staying home when sick with symptoms of infectious illness including COVID-19, and regular cleaning to help reduce transmission risk. A distance of at least 6 feet is recommended between students and teachers/staff, and between teachers/staff who are not fully vaccinated. Mask use by all students, teachers, staff, and visitors is particularly important when physical distance cannot be maintained.

Cohorting: Cohorting means keeping people together in a small group and having each group stay together throughout an entire day. Cohorting can be used to limit the number of students, teachers, and staff who come in contact with each other, especially when it is challenging to maintain physical distancing, such as among young children, and particularly in areas of moderate-to-high transmission levels. The use of cohorting can limit the spread of COVID-19 between cohorts but should not replace other prevention measures within each group. Cohorting people who are fully vaccinated and people who are not fully vaccinated into separate cohorts is not recommended. It is a school's responsibility to ensure that cohorting is done in an equitable manner that does not perpetuate academic, racial, or other tracking, as described in the U.S. Department of Education COVID-19 Handbook, Volume 1 .

4. Screening Testing

Screening testing identifies infected people, including those with or without symptoms (or before development of symptoms) who may be contagious, so that measures can be taken to prevent further transmission. In K-12 schools, screening testing can help promptly identify and isolate cases, quarantine those who may have been exposed to COVID-19 and are not fully vaccinated, and identify clusters to reduce the risk to in-person education. CDC guidance provides that people who are fully vaccinated do not need to participate in screening testing and do not need to quarantine if they do not have any symptoms. Decisions regarding screening testing may be made at the state or local level. Screening testing may be most valuable in areas with substantial or high community transmission levels, in areas with low vaccination coverage, and in schools where other prevention strategies are not implemented. More frequent testing can increase effectiveness, but feasibility of increased

testing in schools needs to be considered. Screening testing should be done in a way that ensures the ability to maintain confidentiality of results and protect student, teacher, and staff privacy. Consistent with state legal requirements and Family Educational Rights and Privacy Act (FERPA), K-12 schools should obtain parental consent for minor students and assent/consent for students themselves.

Screening testing can be used to help evaluate and adjust prevention strategies and provide added protection for schools that are not able to provide optimal physical distance between students. Screening testing should be offered to students who have not been fully vaccinated when community transmission is at moderate, substantial, or high levels (Table 1); at any level of community transmission, screening testing should be offered to all teachers and staff who have not been fully vaccinated. To be effective, the screening program should test at least once per week, and rapidly (within 24 hours) report results. Screening testing more than once a week might be more effective at interrupting transmission. Schools may consider multiple screening testing strategies, for example, testing a random sample of at least 10% of students who are not fully vaccinated, or conducting pooled testing of cohorts. Testing in low-prevalence settings might produce false positive results, but testing can provide an important prevention strategy and safety net to support in-person education.

To facilitate safe participation in sports, extracurricular activities, and other activities with elevated risk (such as activities that involve singing, shouting, band, and exercise that could lead to increased exhalation), schools should consider implementing screening testing for participants who are not fully vaccinated. Schools can routinely test student athletes, participants, coaches, and trainers, and other people (such as adult volunteers) who are not fully vaccinated and could come into close contact with others during these activities. Schools should consider implementing screening testing of participants who are not fully vaccinated up to 24 hours before sporting, competition, or extracurricular events. Schools can use different screening testing strategies for lower-risk sports. High-risk sports and extracurricular activities should be virtual or canceled in areas of high community transmission unless all participants are fully vaccinated.

Funding provided through the ELC Reopening Schools award is primarily focused on providing needed resources to implement screening testing programs in schools aligned with the CDC recommendations. Learn more ELC Reopening Schools: Support for Screening Testing to Reopen & Keep Schools Operating Safely Guidance. Resources are available to support school testing – see Appendix 2: Testing Strategies for COVID-19 Prevention in K-12 Schools.

Table 1. Screening Testing Recommendations for K-12 Schools by Level of Community Transmission

	Low Transmission[1] Blue	Moderate Transmission Yellow	Substantial Transmission Orange	High Transmission Red
Students	Do not need to screen students.	**Offer screening testing for students** who are not fully vaccinated at least once per week.		
Teachers and staff	**Offer screening testing for teachers and staff** who are not fully vaccinated at least once per week.			
High risk sports and activities	**Recommend screening testing for high-risk sports[2] and extracurricular activities[3]** at least once per week for participants who are not fully vaccinated.		**Recommend screening testing for high-risk sports and extracurricular activities** twice per week for participants who are not fully vaccinated.	**Cancel or hold high-risk sports and extracurricular activities virtually** to protect in-person learning, unless all participants are fully vaccinated.
Low- and intermediate-risk sports	Do not need to screen students participating in low- and intermediate-risk sports.[2]	**Recommend screening testing for low- and intermediate-risk sports** at least once per week for participants who are not fully vaccinated.		

[1] Levels of community transmission defined as total new cases per 100,000 persons in the past 7 days (low, 0-9; moderate 10-49; substantial, 50-99, high, ≥100) and percentage of positive tests in the past 7 days (low, <5%; moderate, 5-7.9%; substantial, 8-9.9%; high, ≥10%.)

[2] Examples of low-risk sports are diving and golf; intermediate-risk sport examples are baseball and cross country; high-risk sport examples are football and wrestling.

[3]High-risk extracurricular activities are those in which increased exhalation occurs, such as activities that involve singing, shouting, band, or exercise, especially when conducted indoors.

5. Ventilation

Improving ventilation is an important COVID-19 prevention strategy that can reduce the number of virus particles in the air. Along with other preventive strategies, including wearing a well-fitting, multi-layered mask, bringing fresh outdoor air into a building helps keep virus particles from concentrating inside. This can be done by opening multiple doors and windows, using child-safe fans to increase the effectiveness of open windows, and making changes to the HVAC or air filtration systems.

During transportation, open or crack windows in buses and other forms of transportation, if doing so does not pose a safety risk. Keeping windows open a few inches improves air circulation.

For more specific information about maintenance, use of ventilation equipment, actions to improve ventilation, and other ventilation considerations, refer to:

- CDC's Ventilation in Schools and Child care Programs
- CDC's Ventilation in Buildings webpage
- CDC's Ventilation FAQs and
- CDC's Improving Ventilation in Your Home

Additional ventilation recommendations for different types of school buildings can be found in the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) schools and universities guidance document.

Funds provided through the Elementary and Secondary Schools Emergency Relief Programs and the Governor's Emergency Education Relief Programs can support improvements to ventilation. Please see question B-7 of the U.S. Department of Education Uses of Funds guidance for these programs.

6. Handwashing and Respiratory Etiquette

People should practice handwashing and respiratory etiquette (covering coughs and sneezes) to keep from getting and spreading infectious illnesses including COVID-19. Schools can monitor and reinforce these behaviors and provide adequate handwashing supplies.

- Teach and reinforce handwashing with soap and water for at least 20 seconds.
- Remind everyone in the facility to wash hands frequently and assist young children with handwashing.
- If handwashing is not possible, use hand sanitizer containing at least 60% alcohol (for teachers, staff, and older students who can safely use hand sanitizer). Hand sanitizers should be stored up, away, and out of sight of young children and should be used only with adult supervision for children under 6 years of age.

7. Staying Home When Sick and Getting Tested

Students, teachers, and staff who have symptoms of infectious illness, such as influenza (flu) or COVID-19, should stay home and be referred to their healthcare provider for testing and care, regardless of vaccination status. Staying home when sick with COVID-19 is essential to keep COVID-19 infections out of schools and prevent spread to others. Schools should also allow flexible, non-punitive, and supportive paid sick leave policies and practices that encourage sick workers to stay home without fear of retaliation, loss of pay, or loss of employment level and provide excused absences for students who are sick. Employers should ensure that workers are aware of and understand these policies. If a student becomes sick at school, see

What to do if a Student Becomes Sick or Reports a New COVID-19 Diagnosis at School. If a school does not have a routine screening testing program, the ability to do rapid testing on site could facilitate COVID-19 diagnosis and inform the need for quarantine of close contacts and isolation.

Schools should educate teachers, staff, and families about when they and their children should stay home and when they can return to school. During the COVID-19 pandemic, it is essential that parents keep children home if they are showing signs and symptoms of COVID-19 and get them tested.

Getting tested for COVID-19 when symptoms are compatible with COVID-19 will help with rapid contact tracing and prevent possible spread at schools, especially if key prevention strategies (masking and distancing) are not in use. Some localities might choose to use testing to shorten quarantine periods.

8. Contact Tracing in Combination with Isolation and Quarantine

Schools should continue to collaborate with state and local health departments, to the extent allowable by privacy laws and other applicable laws, to confidentially provide information about people diagnosed with or exposed to COVID-19. This allows identifying which students, teachers, and staff with positive COVID-19 test results should isolate, and which close contacts should quarantine.

- Fully vaccinated close contacts should be referred for COVID-19 testing. If asymptomatic, fully vaccinated close contacts do not need to quarantine at home following an exposure (they can continue to attend school in-person and participate in other activities). In addition to correctly wearing masks in school, they should wear a mask in other indoor public settings for 14 days or until they receive a negative test result.
- Close contacts who are not fully vaccinated should be referred for COVID-19 testing. Regardless of test result, they should quarantine at home for 14 days after exposure. Options to shorten quarantine provide acceptable alternatives of a 10-day quarantine or a 7-day quarantine combined with testing and a negative test result.

See the added exception in the close contact definition for the exclusion of students in the K-12 indoor classroom who are within 3 to 6 feet of an infected student with masking. See the Department of Education's Protecting Student Privacy FERPA and the Coronavirus Disease 2019 for more information.

Schools should report, to the extent allowable by applicable privacy laws, new diagnoses of COVID-19 to their state or local health department as soon as they are informed. School officials should notify, to the extent allowable by applicable privacy laws, teachers, staff, and families of students who were close contacts as soon as possible (within the same day if possible) after they are notified that someone in the school has tested positive.

9. Cleaning and Disinfection

In general, cleaning once a day is usually enough to sufficiently remove potential virus that may be on surfaces. Disinfecting (using disinfectants on the U.S. Environmental Protection Agency COVID-19 list) removes any remaining germs on surfaces, which further reduces any risk of spreading infection.

For more information on cleaning a facility regularly, when to clean more frequently or disinfect, cleaning a facility when someone is sick, safe storage of cleaning and disinfecting products, and considerations for protecting workers who clean facilities, see Cleaning and Disinfecting Your Facility.

If a facility has had a sick person or someone who tested positive for COVID-19 within the last 24 hours, clean AND disinfect the space.

Section 2: Additional Considerations for K-12 Schools

Disabilities or Other Health Care Needs

Provide accommodations, modifications, and assistance for students, teachers, and staff with disabilities and other health care needs when implementing COVID-19 safety protocols:

- Work with families to better understand the individual needs of students with disabilities.

- Remain accessible for students with disabilities:
  - Help provide access for direct service providers (DSP) (e.g., paraprofessionals, therapists, early intervention specialists, mental health and healthcare consultants, and others). If DSPs who are not fully vaccinated provide services at more than one location, ask whether any of their other service locations have had COVID-19 cases.
  - Ensure access to services for students with disabilities when developing cohorts.
- Adjust strategies as needed
  - Be aware that physical distancing and wearing masks can be difficult for young children and people with certain disabilities (for example, visual or hearing impairments) or for those with sensory or cognitive issues.
  - For people who are only able to wear masks some of the time for the reasons above, prioritize having them wear masks during times when it is difficult to separate students and/or teachers and staff (e.g., while standing in line or during drop off and pick up).
  - Consider having teachers and staff wear a clear or cloth mask with a clear panel when interacting with young students, students learning to read, or when interacting with people who rely on reading lips.
  - Use behavioral techniques (such as modeling and reinforcing desired behaviors and using picture schedules, timers, visual cues, and positive reinforcement) to help all students adjust to transitions or changes in routines.

Please see Guidance for Direct Service Providers for resources for DSPs serving children with disabilities or other health care needs during COVID-19.

Visitors

Schools should review their rules for visitors and family engagement activities.

- Schools should limit nonessential visitors, volunteers, and activities involving external groups or organizations, particularly in areas where there is moderate-to-high COVID-19 community transmission.
- Schools should not limit access for direct service providers, but can ensure compliance with school visitor polices.
- Schools should continue to emphasize the importance of staying home when sick. Anyone, including visitors, who have symptoms of infectious illness, such as flu or COVID-19, should stay home and seek testing and care, regardless of vaccination status.

Food Service and School Meals

- Staff should wear masks at all times during meal preparation and service, and during breaks except when eating or drinking.
- Students should wear masks when moving through the food service line.
- Maximize physical distance as much as possible when moving through the food service line and while eating (especially indoors). Using additional spaces outside of the cafeteria for mealtime seating such as the gymnasium or outdoor seating can help facilitate distancing. Students should not be excluded from in-person learning to keep a minimum distance requirement, including during mealtimes.
- Given very low risk of transmission from surfaces and shared objects, there is no need to limit food service approaches to single use items and packaged meals.
- Clean frequently touched surfaces. Surfaces that come in contact with food should be washed, rinsed, and sanitized before and after meals.
- Promote hand washing before, after, and during shifts, before and after eating, after using the toilet, and after handling garbage, dirty dishes, or removing gloves.
- Improve ventilation in food preparation, service, and seating areas.
- U.S. Department of Agriculture has issued several Child Nutrition COVID-19 Waivers. Learn more here .

Recess and Physical Education

In general, people do not need to wear masks when outdoors (e.g., participating in outdoor play, recess, and physical education activities). CDC recommends people who are not fully vaccinated wear a mask in crowded outdoor settings or during activities that involve sustained close contact with other people. Fully vaccinated people might choose to wear a mask

in crowded outdoor settings if they or someone in their household is immunocompromised. Universal masking is recommended during indoor physical education or recess.

Sports and Other Extracurricular Activities

School-sponsored sports and extracurricular activities provide students with enrichment opportunities that can help them learn and achieve, and support their social, emotional, and mental health. Due to increased exhalation that occurs during physical activity, some sports can put players, coaches, trainers, and others at increased risk for getting and spreading COVID-19. Close contact sports and indoor sports are particularly risky. Similar risks might exist for other extracurricular activities, such as band, choir, theater, and school clubs that meet indoors.

Prevention strategies in these activities remain important and should comply with school day policies and procedures. People who are fully vaccinated can refrain from quarantine following a known exposure if asymptomatic, facilitating continued participation in in-person learning, sports, and extracurricular activities. Students should refrain from these activities when they have symptoms consistent with COVID-19 and should be tested. Schools are strongly encouraged to use screening testing (Table 1) for student athletes and adults (e.g., coaches, teachers, advisors) who are not fully vaccinated who participate in and support these activities to facilitate safe participation and reduce risk of transmission – and avoid jeopardizing in-person education due to outbreaks.

Coaches and school sports administrators should also consider specific sport-related risks:

- **Setting of the sporting event or activity.** In general, the risk of COVID-19 transmission is lower when playing outdoors than in indoor settings. Consider the ability to keep physical distancing in various settings at the sporting event (i.e., fields, benches/team areas, locker rooms, spectator viewing areas, spectator facilities/restrooms, etc.).
- **Physical closeness.** Spread of COVID-19 is more likely to occur in sports that require sustained close contact (such as wrestling, hockey, football).
- **Number of people.** Risk of spread of COVID-19 increases with increasing numbers of athletes, spectators, teachers, and staff.
- **Level of intensity of activity.** The risk of COVID-19 spread increases with the intensity of the sport.
- **Duration of time.** The risk of COVID-19 spread increases the more time athletes, coaches, teachers, staff and spectators spend in close proximity or in indoor group settings. This includes time spent traveling to/from sporting events, meetings, meals, and other settings related to the event.
- **Presence of people more likely to develop severe illness.** People at increased risk of severe illness might need to take extra precautions.

Section 3: School Workers

Workers at increased risk for severe illness from COVID-19 include older adults and people of any age with certain underlying medical conditions if they are not fully vaccinated. Workers who have an underlying medical condition or are taking medication that weakens their immune system may NOT be fully protected even if fully vaccinated and may need to continue using additional prevention measures. Policies and procedures addressing issues related to workers at higher risk of serious illness should be made in consultation with occupational medicine and human resource professionals, keeping in mind Equal Employment Opportunity concerns and guidance. Employers should also understand the potential mental health strains for workers during the COVID-19 pandemic. CDC recommends that school administrators should educate workers on mental health awareness and share available mental health and counseling services. Employers should provide a supportive work environment for workers coping with job stress and building resilience, and managing workplace fatigue.

As part of each school's response plan, administrators should conduct workplace hazard assessments periodically to identify COVID-19 transmission risks and prevention strategies, when worksite conditions change, or when there are instances of COVID-19 transmission within the workplace. Strategies to prevent and reduce transmission are based on an approach that prioritizes the most effective practices, known as the hierarchy of controls. School employers should engage and train all workers on potential workplace hazards, what precautions should be taken to protect workers, and workplace policies for reporting concerns. Schools should ensure communication and training for all workers are frequent and easy to understand. Additionally, schools should ensure communication and training are in a language, format, and at a literacy level that workers understand.

Workers in K-12 have the right to a safe and healthful workplace. The Occupational Safety and Health Administration (OSHA) has issued Guidance on Mitigating and Preventing the Spread of COVID-19 in the Workplace. This guidance contains recommendations to help employers provide a safe and healthy workplace free from recognized hazards that are causing, or are likely to cause, death or serious physical harm. It also contains descriptions of mandatory safety and health standards. If a worker believes working conditions are unsafe or unhealthful, they or a representative may file a confidential safety and health complaint with OSHA at any time. In states where public sector employers and workers are not covered by OSHA-approved State Plans, there may be agencies that provide public worker occupational safety and health protections and enforce such workers' rights to safe workplaces. Workers should contact state, county, and/or municipal government entities to learn more.

Appendix 1: Planning and Preparing

Emergency Operations Plans

Each school district and school should have an Emergency Operations Plan (EOP) in place to protect students, teachers, staff, and families from the spread of COVID-19 and other emergencies. The EOP should:

- Describe COVID-19 prevention strategies to be implemented.
- Describe steps to take when a student, teacher, or staff member has been exposed to someone with COVID-19, has symptoms of COVID-19, or tests positive for COVID-19.
- Document policy or protocol differences for people who are fully vaccinated for COVID-19 versus those who are not fully vaccinated.
- Be developed in collaboration with regulatory agencies and state, local, territorial, and tribal public health departments, and comply with state and local licensing regulations.
- Be developed with involvement of teachers, staff, parents and guardians, and other community partners (for example, health centers).

Utilize the Whole School, Whole Community, Whole Child (WSCC) model to outline EOP policies and protocols across each component. Tools and resources from the U.S. Department of Education can be used by K-12 administrators to develop and update their EOP.

Vaccination Verification

Existing laws and regulations require certain vaccinations for children attending school. K-12 administrators regularly maintain documentation of people's immunization records. Administrators who maintain documentation of students' and workers' COVID-19 vaccination status can use this information, consistent with applicable laws and regulations, including those related to privacy, to inform prevention strategies, school-based testing, contact tracing efforts, and quarantine and isolation practices. Schools that plan to request voluntary submission of documentation of COVID-19 vaccination status should use the same standard protocols that are used to collect and secure other immunization or health status information from students. The protocol to collect, secure, use, and further disclose this information should comply with relevant statutory and regulatory requirements, including Family Educational Rights and Privacy Act (FERPA) statutory and regulatory requirements. Policies or practices related to providing or receiving proof of COVID-19 vaccination should comply with all relevant state, tribal, local, or territorial laws and regulations.

As part of their workplace COVID-19 vaccination policy, schools should recognize that a worker who cannot get vaccinated due to a disability (covered by the ADA), has a disability that affects their ability to have a full immune response to vaccination, or has a sincerely held religious belief or practice (covered by Title VII of the Civil Rights Act of 1964) may be entitled to a reasonable accommodation that does not pose an undue hardship on the operation of the employer's business. Additionally, school employers should advise workers with weakened immune systems about the importance of talking to their healthcare professional about the need for continued personal protective measures after vaccination. For more information on what you should know about COVID-19 and the ADA, the Rehabilitation Act and other Equal Employment Opportunity Laws visit the Equal Employment Opportunity Commission website.

Appendix 2: Testing Strategies for COVID-19 Prevention in K-12 Schools

Testing Benefits

School testing gives communities, schools, and families added assurance that schools can open and remain open safely for all students. By identifying infections early, testing helps keep COVID-19 transmission low and students in school for in-person learning, sports, and extracurricular activities. Screening testing is likely to be most feasible in larger settings and for older children and adolescents.

Collaboration between Education and Public Health

Before implementing COVID-19 testing in their schools, K–12 school leaders should coordinate with public health officials to develop a testing plan and build support from students, parents, teachers, and staff and must ensure that such screening testing is administered consistent with applicable law, including the Protection of Pupil Rights Amendment (PPRA). COVID-19 testing introduces challenges that schools may not have considered in the past (for example, requirements to perform on-site tests and to refer people for confirmatory testing), and public health officials can provide guidance on federal, state, and local requirements for implementing testing. Both school leaders and public health officials should assure the testing plan has key elements in place, including:

- Protocols for screening testing frequency based on community transmission rates, vaccination levels, and prevention strategies implemented at the school.
- Protocols for providing or referring to diagnostic testing for students, teachers, and staff who come to school with symptoms and for students, teachers, and staff following exposure to someone with COVID-19.
- Physical space to conduct testing safely and privately.
- Ability to maintain confidentiality of results and protect student, teacher, and staff privacy.
- Ways to obtain parental consent for minor students and assent/consent for students themselves.
- A mechanism to report all testing results, to the extent allowable by or consistent with applicable federal, state, or local laws and regulations, including privacy laws such as FERA, as required by the state or local health department.
- Roles and responsibilities for contact tracing for each party, including identification of close contacts.

If these elements are not in place, schools may consider referring students, teachers, and staff to community-based testing sites .

Collaboration among local counsel, education, and public health is recommended to ensure appropriate consent is obtained and maintained and results are maintained, used, and further disclosed with appropriate privacy and confidentiality in accordance with the Americans with Disabilities Act (ADA) , Family Educational Rights and Privacy Act (FERPA) , the Protection of Pupil Rights Amendment (PPRA) , and other applicable laws and regulations. School administrators who have questions about FERPA (or PPRA) may contact the Department of Education's Student Privacy Policy Office (SPPO) at https://studentprivacy.ed.gov .

Testing Strategies

Schools may consider testing a random sample of at least 10% of students who are not fully vaccinated or may conduct pooled testing for COVID-19. Random sampling can reduce costs and eliminate bias in the testing design but may require more logistics and planning. Pooled testing increases the number of people who can be tested at once and reduces testing resources used. Pooled testing works best when the number of positives is expected to be very low. Ideally, specimens should be pooled at the laboratory rather than in the classroom. If the pooled test result is positive, each of the samples in the pool will need to be tested individually to determine which samples are positive. This allows for faster isolation of cases and quarantine of close contacts.

More frequent testing may be needed for students, teachers, staff, and adult volunteers who are not fully vaccinated and engaged in school athletics and other extracurricular activities. Testing at least once per week is recommended for high-risk sports and extracurricular activities (those that cannot be done outdoors or with masks) at all community transmission levels. In areas of substantial-to-high community transmission levels, testing twice per week is recommended for participation in these activities. Additionally, if the school is not tracking COVID-19 vaccination status of participants and support teacher and staff screening testing should be encouraged.

Fully vaccinated students, teachers, and staff with no COVID-19 symptoms do not need to quarantine at home following an exposure to someone with COVID-19 but should get tested 5-7 days after exposure. In addition to wearing masks in school, they should wear a mask in other indoor public settings for 14 days or until they receive a negative test. People who have tested positive for COVID-19 within the past 3 months and recovered do not need to get tested following an exposure as long as they do not develop new symptoms. Any fully vaccinated person who experiences symptoms consistent with COVID-19 should isolate themselves from others, be clinically evaluated for COVID-19, and tested for SARS-CoV-2 if indicated.

People with COVID-19 have reported a wide range of symptoms from no or mild symptoms to severe illness. Symptoms may appear 2-14 days after exposure to the SARS-CoV-2 virus. Because some of the symptoms of flu, common cold, and COVID-19 are similar, it is hard to tell the difference between them based on symptoms alone. Testing can help confirm a diagnosis, and inform medical treatment and care. Also, testing will confirm the need to isolate from others for at least 10 days and quarantine close contacts.

Choosing a Test

When considering which tests to use for screening testing, schools or their testing partners should choose tests that can be reliably supplied and provide results within 24 hours. If available, saliva tests and nasal tests that use a short swab may be more easily implemented and accepted in schools. A viral test tells a person if they have a current infection. Two types of viral tests can be used: nucleic acid amplification tests (NAATs) and antigen tests. Frequency of testing should be determined by the performance characteristics of the test being used. The intended use of each test, available in the Instructions for Use and in the Letter of Authorization for each test, defines the population in which the test is intended to be used, the acceptable specimen types, and how the results should be used.

Reporting Results

Schools performing on-site tests (i.e., that are not sent to a laboratory) must apply for a Clinical Laboratory Improvement Amendments (CLIA) certificate of waiver, and report test results to the extent allowable by or consistent with applicable privacy laws to state or local public health departments and as may be mandated by the Coronavirus Aid, Relief, and Economic Security (CARES) Act (P.L. 116-136). Schools should work closely with their local health department when establishing on-site testing so that their performance of CLIA-waived or FDA-authorized point-of-care tests for SARS-CoV-2 is done in accordance with regulations and should work closely with local counsel to ensure the reporting of test results is done in accordance with applicable privacy laws and regulations.

Parents, guardians, and caregivers should be asked to report new diagnoses of COVID-19 to schools and public health authorities to facilitate contact tracing and communication planning for cases and outbreaks. In addition, school administrators should notify teachers, staff, families, and emergency contacts or legal guardians immediately of any case of COVID-19 while maintaining confidentiality in accordance with the Health Insurance Portability and Accountability Act of 1996 (HIPAA), the Americans with Disabilities Act (ADA), the Family Educational Rights and Privacy Act (FERPA) and other applicable laws and regulations. Notifications must be accessible for all students, teachers, and staff, including those with disabilities or limited English proficiency (for example, through use of interpreters or translated materials).

Ethical Considerations for School-Based Testing

- Testing should be conducted with informed consent from the person being tested (if an adult) or the person's parent or guardian (if a minor), consistent with applicable state laws related to consent. Informed consent requires disclosure, understanding, and free choice, and is necessary for teachers, staff (who are employees of a school) and students' families, to act independently and make choices according to their values, goals, and preferences.
- Consider distributing consent forms with the other paperwork for returning to school and making them easily accessible.
- Differences in position and authority (i.e., workplace hierarchies), as well as employment and educational status, can affect a person's ability to make free decisions. CDC provides guidance and information related to consent for COVID-19 testing among employees.
- The benefits of school-based testing need to be weighed against the costs, inconvenience, and feasibility of such programs to both schools and families. These challenges must be considered carefully and addressed as part of plans for school-based testing developed in collaboration with public health officials. The burden of testing is likely to be higher for younger children and therefore screening testing may be more feasible and acceptable for older children and adolescents.

Resources to Support School Screening Testing Programs

- CDC ELC Cooperative Agreement Reopening Schools Award provides $10 billion to support COVID-19 screening testing in schools for safe, in-person learning.
- COVID-19 Testing and Diagnostics Working Group | HHS.gov develops testing-related guidance and provides tailored or focused investments to expand the available testing supply and maximize testing capacity.
- Increasing Community Access to Testing provides COVID-19 testing resources and support to underserved school districts.
- Operation Expanded Testing expands national COVID-19 testing capacity and support for K-8 schools and groups at higher risk of COVID-19 through three regional hubs:
  - Northeast and South
  - Midwest
  - West
- National Institutes of Health RADx Initiative rapidly scales up testing across the country to enhance access to those most in need and provides a When to Test impact calculator which illustrates how different mitigation strategies can minimize the spread of COVID-19.
- Shah Family Foundation Open and Safe Schools toolkit provides school leaders resources and tools to implement COVID-19 screening testing.
- Rockefeller Foundation has created a playbook with detailed, step-by-step guidance to help design and implement effective testing programs in schools. It addresses the operational challenges and everyday realities of implementing a complex, logistical program in an easy-to-understand, practical guide.
- The U.S. Department of Education's COVID-19 Resources for Schools, Students, and Families provides up-to-date guidance and policies to support life-long learning while addressing challenges presented by COVID-19.

Last Updated Oct. 22, 2021

Exhibit N

OREGON DEPARTMENT OF EDUCATION
Oregon achieves . . . together!

Oregon Health Authority

Ready Schools, Safe Learners Resiliency Framework for the 2021-22 School Year

Updated September 9, 2021

Exhibit N

OREGON DEPARTMENT OF EDUCATION Oregon achieves ... together!

Oregon Health Authority

Table of Contents

For the 2021-2022 school year, schools must plan to provide full-time, in-person education for all students every school day.[1] Districts will make decisions with their boards to determine local implementation of COVID-19 mitigation measures, as laid out in this document.

Overview

Authority and Effective Dates

This **Ready Schools, Safe Learners Resiliency Framework for the 2021-22 School Year** replaces Ready Schools, Safe Learners: Guidance for School Year 2020-21 version 7.5.2 issued on May 28, 2021. The **Ready Schools, Safe Learners Resiliency Framework for the 2021-22 School Year** becomes effective on June 30, 2021. The Resiliency Framework may be used for summer school 2021 as well as school year 2021-22.

Changes in the amount of community transmission of COVID-19, the severity of illness associated with new variants of the SARS-CoV-2 virus that causes COVID-19, or the availability of vaccination for children younger than 12 years old may warrant changes to the state's recovery efforts during the school year. The Resiliency Framework will be updated to reflect any changes.

The vast majority of health and safety measures in this Resiliency Framework are *advisory*, and are offered to schools to support successful full-time, in-person instruction for the 2021-22 school year. Where this framework does not require a specific action by a school district, a district may choose whether to consider or implement advisory information or recommendations.

Prior to the COVID-19 pandemic, state law and rules included several components related to managing communicable disease in schools, including required isolation, quarantine and school exclusion for certain diseases. These requirements continue to exist in state law and rule.

Nothing in this framework is intended to provide legal advice. ODE encourages districts to consult with their own legal counsel and to consider other state and federal guidance and laws when implementing any recommendations.

[1] Schools that are virtual or online schools are not required to provide daily in-person instruction.

ODE and OHA will continue to monitor guidance updates from the CDC, and will continue to align this recommendation framework as needed.

Local Decision Making

This Resiliency Framework was developed jointly by the Oregon Department of Education (ODE) and the Oregon Health Authority (OHA) and is informed by U.S. Department of Education and CDC guidance along with information from many other sources. **Except where compliance is mandated by existing state law, this Resiliency Framework is *advisory*. Requirements are followed by the rule reference for ease of identification.**

Decisions about when or how schools respond to an outbreak of COVID-19 involve collaboration across multiple actors. If part of or an entire school needs to close to in-person instruction as a matter of public health, it is important that educators, students, families, and the general public have a clear understanding of how decisions are made and who makes those decisions.

When determining how to best support in-person learning during the 2021-22 school year, schools should work in a collaborative manner with local public health authorities (LPHAs). LPHAs are vital partners to advise and consult on health and safety in schools with school officials. In general **decisions of school health and safety reside with school and district officials**. ODE's updated Decision Tools may be a useful resource. There can be exceptions within local law and any additional authorities should be clarified by schools and LPHAs at the local level. Additionally, the authority of an educational governing body or school leader to close a school facility may vary depending on what governance structure is in place and the type of school.

If a local public health authority has concerns about public health in a given school in response to an outbreak and the school or district disagree, these concerns may be elevated to the State Public Health Director or the Director of the Oregon Department of Education.

The State Public Health Director at the Oregon Health Authority has broad authority to close a facility that presents a public health risk.

The Director of ODE has authority to close a school facility within existing state laws.

Oregon OSHA enforces workplace safety rules and statutes. Oregon OSHA will address employee and other inquiries and complaints, and provide advice to employers related to any potential violation of existing Oregon OSHA rules if they involve potential workplace exposure. If you believe a school is not in compliance with the RSSL guidance you can file a named or confidential complaint with Oregon OSHA at 1-833-604-0884 or online.

Monitoring Local Data

Together with local public health officials, school administrators should consider multiple factors when they make decisions about implementing layered prevention protocols against COVID-19. Since schools typically serve their surrounding communities, decisions should be based on the school population, families and students served, as well as their communities.

ODE has worked to create the "Oregon Data for Decisions Guide" which is a resource for school leaders to use to inform decision-making at the local level. The guide suggests data points for communities to consider along with a clear format for conducting a comprehensive review of information and data. In addition, ODE has partnered with Willamette ESD to create a new "Data for Decisions Dashboard," a tool to provide up-to-date data that will continue to grow over the coming weeks and months.

Schools will gather people who are fully vaccinated and people who are not fully vaccinated. Elementary schools primarily serve children under 12 years of age who are not eligible for the COVID-19 vaccine at this time. Other schools (e.g., middle schools, K-8 schools) may also have students who are not yet eligible for COVID-19 vaccination. Some schools (e.g., high schools) may have a low percentage of students and staff fully vaccinated despite vaccine eligibility. These variations require K-12 administrators to make decisions about the use of COVID-19 prevention strategies in their schools to protect people who are not fully vaccinated.

The primary factors to consider include:

- Level of community transmission of COVID-19.
- COVID-19 vaccination coverage in the community and among students, teachers, and staff.
- Use of a frequent COVID-19 screening testing program for students, teachers, and staff.
- COVID-19 outbreaks or increasing trends in the school or surrounding community.
- *Ages, sociodemographics, and developmental status of children served by K-12 schools and the associated cognitive, social and behavioral factors that may affect risk of transmission and the feasibility of different prevention strategies.*
- Students and staff who warrant extra precautions due to being at increased risk of severe COVID-19 illness.

COVID-19 Health and Safety

The Resiliency Framework focuses on *advisory* health and safety recommendations that provide for flexibility to:

- Return to full-time, in-person instruction for all students,
- Honor and recognize the uniqueness of communities across Oregon, and

- Support schools in health and safety planning to meet community-specific needs and strengths.

As schools plan for the fall 2021 in-person school year, it is important to remember:

- Our communities will be living with the virus until there is widespread immunity.
- COVID-19 continues to change with new variants, our knowledge of mitigation efforts grows over time. For these reasons the guidance for responding to COVID-19 also changes.
- Right now, the best tools to protect individuals are vaccination for those eligible, physical distancing, face coverings, ventilation and airflow, hand hygiene, and staying home if ill or exposed to someone with COVID-19.
- Opportunity for transmission decreases with each mitigation effort that is implemented.

As districts plan and implement the recommendations included in this document, they will necessarily need to consider a continuum of risk levels when all recommendations cannot be fully implemented. For example, maintaining physical distance between people is one of the most effective preventive measures. However, there will be times when this is not possible based on a specific interaction or a physical space limitation. It will be necessary to consider and balance the mitigation strategies described in these recommendations to best protect health and safety while ensuring full time in person learning.

Equity

The Oregon Department of Education is committed to promoting educational systems that support every child's identity, health and well-being, beauty, and strengths. As such, equity must not be a standalone consideration and should inform every decision. Much of this document is technical in nature; however, every decision has the potential to disproportionately impact those whom existing systems most marginalize and historically underserved communities by exacerbating existing conditions of inequity. ODE and OHA sought to apply an equity-informed, anti-racist, and anti-oppressive lens across all sections of the Resiliency Framework.

ODE remains committed to the guiding principles introduced in spring 2020 to generate collective action and leadership for efforts to respond to COVID-19 across Oregon. These principles are updated to reflect the current context:

- **Ensure safety and wellness**. Prioritizing basic needs such as food, shelter, wellness, supportive relationships and support for mental, social, and emotional health of students and staff.
- **Center health and well-being**. Acknowledging the health and mental health impacts of this past year, commit to creating learning opportunities that foster creative expression,

make space for reflection and connection, and center on the needs of the whole child rather than solely emphasizing academic achievement.

- **Cultivate connection and relationship**. Reconnecting with one another after a year of separation can occur through quality learning experiences and deep interpersonal relationships among families, students and staff.
- **Prioritize equity**. Recognize the disproportionate impact of COVID-19 on Black, American Indian/Alaska Native, and Latino/a/x, Pacific Islander communities; students experiencing disabilities; students living in rural areas; and students and families navigating poverty and houselessness. Apply an equity-informed, anti-racist, and anti-oppressive lens to promote culturally sustaining and revitalizing educational systems that support every child.
- **Innovate**. Returning to school is an opportunity to improve teaching and learning by iterating on new instructional strategies, rethinking learning environments, and investing in creative approaches to address unfinished learning.

Safeguarding Student Opportunity

Maintaining rigorous expectations and support to accelerate learning for all students is part of providing an equitable education. As such, any decision for students related to progression within a course sequence; grade entry, grade promotion or retention; placement in advanced courses, dual credit courses or accelerated learning; or participation in extra-curricular activities should include the following:

- A priority for the student to enter school at the grade level associated with their age (compulsory attendance does not begin until age 6 in Oregon) and to be promoted to the next grade level regardless of opportunity to access and fully participate in school during the pandemic and any impact that had on the student's attendance and academic performance.
- A priority for the student to be included in every possible educational and school opportunity (advanced courses, extra-curricular activities, etc.) regardless of opportunity to access and fully participate in school during the pandemic and any impact that had on the student's attendance and academic performance.
- Review of multiple data sources.
- Meaningful engagement with families, educators/staff that considers:
    - Short- and long-term unintended consequences of retention or exclusion on the student's social-emotional well-being, academic success, and status.
    - Cultural implications and stigma associated with retention or exclusion for the student and family.
    - Student voice and input.

A student's academic performance and/or attendance during the spring of 2020 or the 2020-21 school year should not be the sole determinant for decision making.

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Requirements in Federal and State Statute and Rule

Existing federal law includes the following requirements for school districts:

The Centers for Disease Control and Prevention (CDC) issued an Order on January 29, 2021 requiring the wearing of masks by people on public transportation conveyances or on the premises of transportation hubs to prevent spread of the virus that causes COVID-19. This Order was effective as of 11:59 p.m. February 1, 2021 and was published in the Federal Register on February 3, 2021. **The CDC order for mandatory use of face coverings on public transit applies to school buses until lifted by the federal government and cannot be waived by state or local authorities.** The text of the federal order and the CDC guidance is available on the CDC website. In addition, the CDC has provided clarity through these FAQs. Please note that this federal law applies to both public and private schools.

Existing state law and rule include the following requirements for schools and districts:

2021 Additions to Existing Rules

Educator Vaccinations

On August 25, 2021, OHA adopted OAR 333-019-1030 COVID-19 Vaccination Requirements for Teachers and School Staff. ODE and OHA have created a set of FAQs to answer district and school questions about this rule.

Effective October 18, 2021, teachers, school staff and volunteers may not teach, work, learn, study, assist, observe, or volunteer at a school unless they are fully vaccinated or have provided documentation of a medical or religious exception. And, a school may not employ, contract with, or accept the volunteer services of teachers, school staff or volunteers who are teaching, working, learning, studying, assisting, observing, or volunteering at a school unless the teachers or school staff are fully vaccinated against COVID-19 or have a documented medical or religious exception. This is also true for school-based program staff and volunteers.

The rule also includes those who are not employed but are otherwise engaged to provide goods or services to a school or school-based program through any formal or informal agreement, whether compensated or uncompensated; who provide goods or services at or for a school-based program that includes direct or indirect contact with children or students. It does not include short-term visitors or individuals making deliveries. It also does not include district office, facility or ESD staff who never work at or volunteer in a school setting.

Individuals who request a medical or religious exception must use the OHA forms. Schools that grant an exception to the vaccination requirement must take reasonable steps to ensure that unvaccinated teachers, school staff and volunteers are protected from contracting and spreading COVID-19.

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Face Coverings

Oregon is placing a priority on ensuring that every student is able to attend school in-person for the entire school year. Students are required to attend school, which is a congregate setting where COVID-19 can spread easily if precautions are not taken. Universal and correct use of face coverings keeps students learning in-person. ODE, OHA, the CDC and the American Academy of Pediatrics (AAP) all agree that returning to full-time, in-person learning is best for our children. *A recent CDC Morbidity and Mortality Weekly Report emphasizes the importance of face coverings in schools in the context of the Delta variant of COVID-19.*

On August 27, 2021, OHA updated OAR 333-019-1025 requiring everyone age five (5) or older to wear a face covering anywhere indoors, *and outdoors where people from separate households gather. OHA has completed an FAQ for this rule which has additional detail and information.*

On *September 3*, 2021, OHA *updated* OAR 333-019-1015 requiring face coverings in all K-12 indoor *and outdoor* settings. *ODE has created an FAQ for this rule.* This rule applies to public, private, parochial, charter, youth corrections education programs (YCEP) and juvenile detention education programs (JDEP) or alternative educational programs offering kindergarten through grade 12 or any part thereof. *The rules require the following:*

- All individuals 5 years of age and older to wear a face covering while indoors in a K-12 school, during school hours. Certain accommodations for medical needs or disability may be necessary, *and certain conditions for exceptions are detailed in the OAR 333-019-1015.*
    - Children under 5 who are learning in preschool classrooms that operate in school settings are not required to wear face coverings. In any early learning program serving 0 to 5 year olds, students are not required to wear a face covering.
- *All individuals 5 years of age and older to wear a face covering outdoors when individuals cannot or do not consistently maintain at least 6 feet of physical distance from people not in their household.*
- *All individuals aged two (2) or older who are using public transportation, including riding a school bus operated by a public or private school, must wear a face covering.*

OAR 333-019-1015 and OAR 333-019-1025 *do not require a person* to wear a face covering indoors when playing competitive extracurricular sport at any level, *nor when officiating a competitive sport that requires a high level of physical exertion by the official. OARs 333-019-1015 and 333-019-1025 require all spectators and officials who are not actively officiating at a high level of physical exertion at competitive sport events of any level to wear a face covering.*

OHA will review *OAR 333-019-1015* monthly to determine the need for it to continue. Other COVID-19 mitigation protocols (physical distancing, airflow/ventilation, etc.) remain local decisions.

When students falter in consistently and correctly wearing a face covering, center grace and patience and reteach the expectation. Schools and teams should continually provide instruction and positive reinforcement to help all students adapt to the changes in school facilities.

In the case that a student or family chooses not to wear a face covering for reasons other than medical need or disability, schools should follow district processes to determine how to respond keeping in mind both the responsibility for health and safety and the student's need to access education. Conversations should be progressive and lead to resolution that ideally does not involve suspension. Schools cannot serve a student in-person if they or their family choose not to wear a face covering. Schools may offer a remote or online school option for the student.

A face shield may be worn instead of a face covering if an individual cannot wear a face covering for medical reasons. Face coverings are preferred over face shields, as they provide better containment of small aerosols that can be produced while talking.

A face covering is NOT a substitute for physical distancing. Face coverings are required and maintaining at least 3 feet of physical distancing to the extent possible, especially when indoors *or outdoors* around people from different households.

Group face covering breaks or full classroom face covering breaks are best done outdoors where ventilation and physical distancing are maximized. *Outside of brief outdoor and physically distanced "mask breaks," whenever face coverings are not required by OAR 333-019-1015 or OAR 333-019-1025, they continue to be strongly recommended to reduce the spread of COVID-19.*

At the June 17, 2021 meeting, the State Board of Education took action on two rules:

Operational Plan/Safe Return to In-Person Instruction and Continuity of Services Plan

This plan, available on the ESSER III webpage, replaces the Ready Schools, Safe Learners Operational Blueprint required under Executive Order 21-06. Districts will submit their Safe Return to In-Person Instruction and Continuity of Services plan to ODE by **August 23, 2021** to fulfill the requirements of American Rescue Plan Elementary and Secondary School Emergency Relief (ESSER III) State plan. Districts are required to submit their plan to ODE by **August 23, 2021** to fulfill the Oregon State Board of Education requirement. (OAR 581-022-0105). A date and submission process for public charter schools will be communicated to charter school leaders before the end of July 2021.

COVID-19 Recovery Services

Oregon's Resiliency Framework for the 2021-22 School Year shifts away from the requirements in Ensuring Equity and Access: Aligning Federal and State Requirements. That guidance document was intended to support schools and districts in ensuring that requirements related to specific federal programs continued to be met in the varied instructional models that existed in the 2020-21 school year. As we return to an educational context where in-person instruction is nearly universally available, the expectations in Ensuring Equity and Access are no longer applicable and any information from that document returns to pre-COVID-19 expectations and

requirements.

As schools plan for the 2021-22 school year, it is important that they fully consider how to appropriately support all students in light of their circumstances, including those experiencing disability. For students experiencing disability who are eligible for special education, IEP teams must consider the need for individualized COVID-19 recovery services. Districts are required to:

- Notify parents of the opportunity for the IEP team to consider Individualized COVID-19 Recovery Services and seek their input related to those services.
- Consider the need for Individualized COVID-19 Recovery Services at each initial IEP or annual review meeting through the 2022-23 school year.
- Proactively make decisions about Individualized COVID-19 Recovery Services earlier than the initial IEP or annual review meeting, where appropriate.
- Document district decisions related to these services using the Individualized COVID-19 Recovery Services Review sample form developed by the Department or a form developed by the school district that contains the same content.
- Notify ODE when the district and the parent wish to participate in a Facilitated IEP meeting about Individualized COVID-19 Recovery Services.

Oregon Revised Statute and Oregon Administrative Rule

For the 2021-22 school year, schools and districts will be returning to the existing requirements listed below. The following information is intended to serve as a reminder, and highlight of some of those existing standards that districts need to be aware of as the state transitions away from previous guidance. ODE is finalizing more detailed information about COVID-19 Recovery Services to be released no later than July 22, 2021.

Communicable Disease Management in School Settings

- Maintain a **communicable disease management plan** to describe measures put in place to limit the spread of COVID-19 within the school setting. (**OAR 581-022-2220**)

- School administrators are required to **exclude staff and students from school** whom they have reason to suspect have been exposed to COVID-19. (**OAR 333-019-0010**; **OAR 333-019-0010**)

- School administrators should **plan for and maintain health care and space** that is appropriately supervised and adequately equipped for providing first aid, and **isolates** the sick or injured student. (**OAR 581-022-2220.**)

Instruction, Attendance and Enrollment

- Districts must meet all standard **instructional time requirements in Division 22** (**OAR 581-022-0102(30)** and **OAR 581-022-2320**).

Districts must ensure that all instructional time, regardless of the program model, meets the definition of instructional time in OAR 581-022-0102(30) and is under the direction or supervision of a licensed or registered teacher, licensed CTE instructor, licensed practitioner, or appropriately assigned Educational Assistant.

During the 2020-21 school year, districts were allowed to include in the calculation of required instructional time of up to an additional 60 hours for staff professional development and up to an additional 60 hours for parent teacher communication to facilitate student learning, including parent teacher conferences, training, and support for distance learning. This flexibility **will not continue into 2021-22** in an effort to maximize time students are directly engaged in classroom learning. It is still appropriate to provide additional professional learning time and additional family engagement time, but not more than 30 hours of each may be counted as instructional time. (OAR 581-022-2320(6))

Instructional Materials

Districts that use digital content as core curriculum for a course of study or any part thereof must complete an independent adoption of the digital instructional materials. (OAR 581-022-2350) If districts did not do this process last year, they will need to indicate this in their Division 22 reporting in fall 2021, and complete the process to resolve this non-compliance. Districts must provide their local school board with the information in sections 1 through 7 of OAR 581-022-2350 to inform the local school board's review and independent adoption of instructional materials.

All adopted materials must comply with the most current National Instructional Materials Accessibility Standard specifications regarding accessible instructional materials. Adopted materials must provide equitable access to all learners, including Emergent Bilingual students, students identified as Talented and Gifted, and students who experience disability. (OAR 581-022-2350; 581-022-2355; 581-015-2060)

State Assessments

School districts are responsible for having a plan for and administering the state assessments to its students as required by state and federal law. (**ORS 329.485**; OAR 581-022-2100)

Attendance and Enrollment

The 10-day drop rule will be reinstated and schools and districts must use the active and inactive roll as required under OAR 581-023-0006(4). For virtual schools, there is a requirement to provide notice of a student's withdrawal to the sponsoring district. (**ORS 338.120(1)(n)**) Students who may be gone for more than 10-days and return to school should be easily re-engaged and re-entered without a full re-enrollment process.

For On-Site Instructional Models, ODE's pre-pandemic attendance and reporting practices are unchanged. A "Day in session" means a scheduled day of instruction during which students are under the guidance and direction of teachers (OAR 581-023-0006(1)(f)) Session day requirements described in the cumulative ADM manual are unchanged; session days may not

be claimed for weekends or holidays or any other day during which a licensed or registered teacher is not available to students. (OAR 581-023-0006(f); **ORS 336.010**; **ORS 187.010**)

For remote instructional models, schools and districts must take daily attendance. Attendance should be demonstrated in a set 24 hour window that the school establishes and communicates to families prior to the school year. The 24 hour window is not required to be from 12:00 a.m. to 11:59 p.m.

Attendance for all instructional models will be defined to include both participation in class activities and substantive interaction with a licensed or registered teacher during a school day or substantive interactions with educational assistants, paraprofessionals, and TAPP family advocates that support meaningful learning and/or attend to student mental health and well-being.

Substantive interactions can be evidenced by any of the following or reasonable equivalents:

- Active participation in a video class;
- A meaningful series of two-way communications between student and teacher via chat, text message, communication app or email;
- A sustained phone call between the teacher or educational assistants/paraprofessionals and the student, or, for younger students, with the parent or guardian of the student.

Schools have a foundational responsibility to notify parents and families of their student's attendance. **ORS 339.071** remains in place in both in-person and distance learning/online instruction to inform parents and families if a student is unexpectedly absent (not pre-excused) by the end of the school day to verify safety of the student. Schools should design systems for both in-person and distance learning that allow the end of the school day to fall at a reasonable time for this notification.

Planning Mental Health Supports

ODE's Integrated Model of Mental Health

ODE recognizes that mental health, which encompasses emotional, social, cognitive and behavioral functioning, is one of the cornerstones of public education, and central to building school cultures and climates where every student, and all who serve them, thrive.

Research has convincingly shown that children and teens do better in school when student and school staff mental health and well-being needs are being met. ODE's Integrated Model of Mental Health, Mental Health Toolkit and Mental Health website were designed to assist districts, schools and ESDs in promoting the mental health and well-being of their school communities.

ODE's Model centers health and well-being in the confluence of four interconnected pillars of

practice: 1) trauma informed care, 2) social emotional learning, 3) racial equity, and 4) strengths-based, culturally relevant prevention and intervention programs within a system of care.

Central to this effort is a commitment to focus on health rather than "fixing what is broken." This means recognizing the inherent strengths, agency, voice, courage and determination of individuals, families, and communities, and asking what strategies they use to thrive in the face of difficult challenges, and how we can celebrate that resilience. To that end, ODE strongly discourages the use of school or district wide mental health screenings, particularly where there may be insufficient services and supports to meet mental health service demands. Instead, we recommend assessing each student on an as-needed basis when questions or concerns regarding their well-being have been identified.

Prioritize Student and Staff Health and Well-being

- Devote several days of time and space at the beginning of the school year, and ample opportunities throughout the year for students and staff to connect and build relationships in and out of the classroom.
- Provide ample class time at the beginning of the school year, as well as ongoing time, space, and creative opportunities and outlets (art, music, movement/dance, creative writing, clubs and interest groups etc.) for students and staff to make sense of their experiences, and to process personal and professional stresses, emotions, trauma, and grief.
- Prioritize linking students and families with culturally responsive mental health services and supports.
- Foster peer/student led initiatives on social-emotional well-being and mental health.

School Safety and Prevention

Oregon's School Safety and Prevention System (SSPS) is designed to provide school districts with a multi-tiered system of supports ranging from curriculum-based universal prevention programs, to safety-based crisis interventions. These offerings include suicide prevention services, behavioral safety assessments, access to the SafeOregon Tip Line, and positive school culture and climate support that includes programs to prevent bullying, cyberbullying, harassment, and intimidation, and to promote mental health and well-being in school districts statewide.

All of these services and supports align with ODE's Integrated Model of Mental Health in that they are equity and racial equity-centered, trauma and SEL-informed, and strengths-centered.

- Create welcoming schools, recognizing that students, families and staff of color may not feel safe in school settings at this time.
- Recognize that the current culture of polarization may increase incidents of bullying, harassment, racism, victimization, and violence within schools.

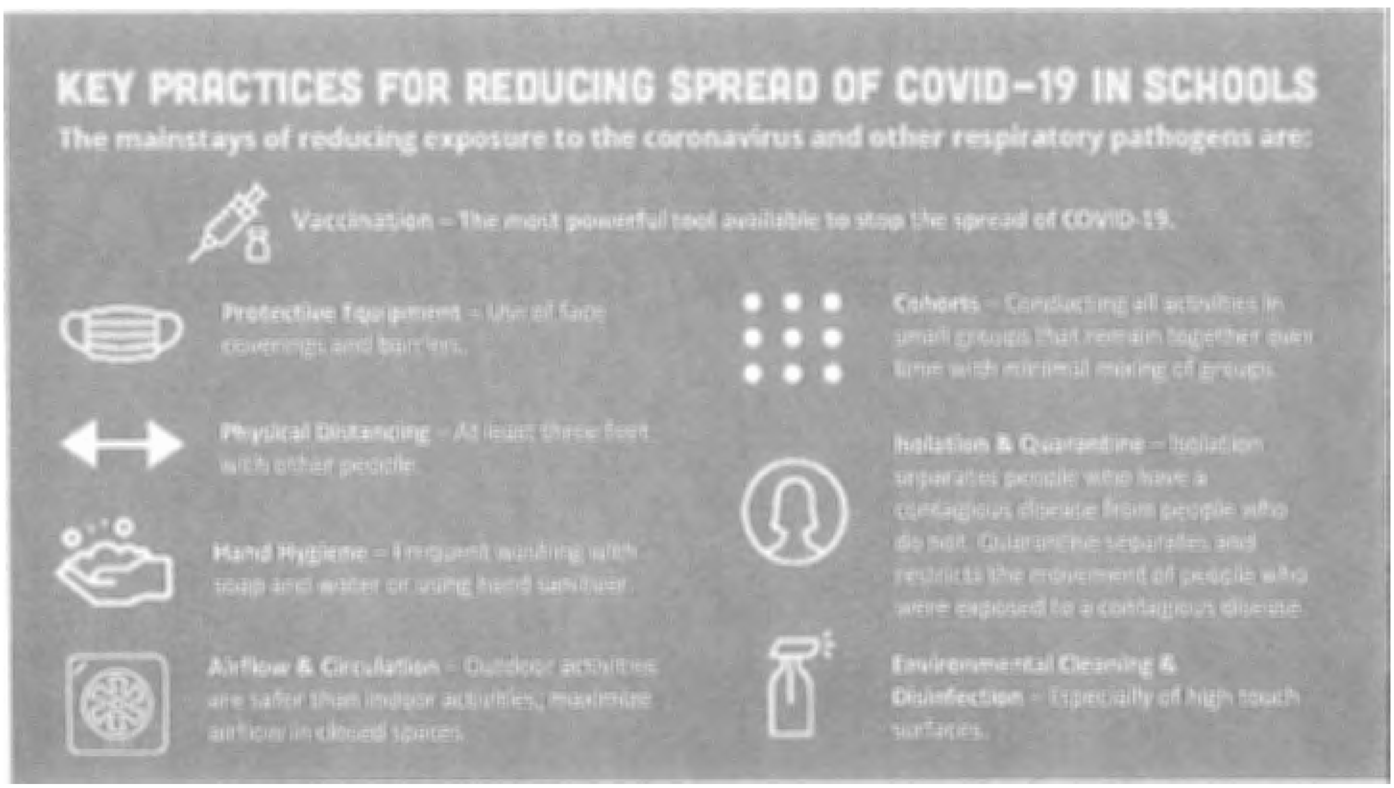
- Contact your regional ESD School Safety and Prevention System (SSPS) Specialist for assistance with SSPS services or supports.

Access to Mental Health Services and Crisis Services

- Strengthen communication throughout communities and school networks via newsletters, district website, social media, etc.
- Ensure school community members have full information regarding available local services including contact information.
- Develop strong relationships, partnerships and contracts (as applicable) with local/county systems of care, coordinated care organizations (CCOs), SBHCs community-based mental health providers, community health workers and others to ensure access to a comprehensive array of culturally-responsive services for students and families.

Advisory Health and Safety Strategies

Everyone in our communities shares in the responsibility to keep our communities safe and healthy. In order to return to full-time, in-person instruction, this responsibility asks each person to both maintain their own health and take actions to protect the health of those with whom they interact. All staff need encouragement, training, support and clear guidelines to meet the health and safety expectations set out by the district, charter, or private school.



COVID-19 Vaccination

Getting vaccinated against COVID-19 is the best way to stop the pandemic, and return society to more typical functioning. Many communities are offering vaccination at school. Everyone age 12 and up is eligible for a free COVID-19 vaccine.

CDC guidance states that people who are fully vaccinated and do not have COVID-19 symptoms do not need to quarantine after an exposure to someone with COVID-19, *and should be tested for COVID-19 infection 3-5 days after exposure, regardless of symptoms.* This protects the student's access to in-person learning, sports and extracurricular activities.

Under Oregon law, youth 15 years and older may give consent to receive medical treatment, including vaccinations, when provided by a physician, physician assistant, naturopath, nurse practitioner, dentist or optometrist, or other professionals operating under the license of these providers. Under OHA guidance, these COVID-19 vaccine registered providers may not require consent from a parent or guardian to vaccinate someone age 15, 16, or 17. With the exception of pharmacies, most locations where COVID-19 vaccinations are provided have oversight by a medical provider on this list.

Parental or guardian consent is required to vaccinate people 12-14 years old, but the parental or guardian consent requirement does not necessarily mean a parent or guardian must go with the youth to receive the vaccination. Written consent may be obtained in advance.

If you are interested in offering a COVID-19 vaccine clinic or event for your school, please contact your LPHA to discuss options for the kind of event you'd like to host.

OHA and ODE strongly advise schools and districts to offer vaccination clinics throughout the school year. *On August 25, 2021, OHA adopted OAR 333-019-1030* COVID-19 Vaccination Requirements for Teachers and School Staff.

Schools and other OHA partners can now request a set of tools to make vaccination events more accessible for everyone. Accessibility Kits support communication and information access for people with disabilities, those who primarily use a language other than English, and anyone who could benefit from accommodations at vaccination sites. Inspired by a prototype from OHSU and in partnership with FEMA's Disability Integration Team, the Accessibility Team at OHA has been working hard to develop and roll out these kits, which are currently being used by partners throughout the state.

Physical Distancing

Many students, like adults, love to embrace, give high-fives, fist bumps, and receive positive adult attention. When students falter in adhering to the new operating procedures, center grace and patience and reteach the expectation. Refrain from implementing consequences that deny access to instruction as a result of these challenges. Schools and teams should continually

provide instruction and positive reinforcement to help all students adapt to the changes in school facilities while ensuring punitive measures are not the methodology to remind, motivate and reinforce healthy practices.

OHA and ODE *strongly advise* that schools support and promote physical distancing as described below:

- Support physical distancing in all daily activities and instruction, maintaining at least 3 feet between students to the extent possible. Maintaining physical distancing should not preclude return to full-time, in-person instruction for all students.
- When it is not possible to maintain a physical distance of at least 3 feet, it is especially important to layer multiple other prevention strategies, such as wearing face coverings.
- Consider physical distancing requirements when setting up learning and other spaces, arranging spaces and groups to allow and encourage at least 3 feet of physical distance.
- Minimize time standing in lines and take steps to ensure that required distance between students is maintained, including marking spacing on floor, one-way traffic flow in constrained spaces, etc.

Cohorting

Cohorting is a significant strategy to reduce COVID-19 spread. Cohorting refers to establishing a consistent group of students that stays together for a significant portion of the school day.

OHA and ODE *strongly advise* that schools design cohorts for students to the extent possible.

Cohorts help manage risks in the potential spread of COVID-19. In particular, the size of the cohort matters for risk management. Student cohorting: (1) limits the number of exposed people when a COVID-19 case is identified in the school, (2) quickly identifies exposed individuals when a COVID-19 case is identified, (3) minimizes the number of people who may need to be quarantined as well as school-wide disruptions in student learning.

In alignment with recommendations from the CDC, the following exception from quarantine is effective in the K–12 indoor classroom setting: students who were within 3 or more feet of an infected student (laboratory-confirmed or a clinically compatible illness) where both students were engaged in consistent and correct use of well-fitting face coverings; and other K–12 school prevention strategies (such as universal and correct face covering use, physical distancing, increased ventilation) were in place in the K–12 school setting. This exception does not apply to teachers, staff, or other adults in the indoor classroom setting.

An exposure is defined as a *susceptible* individual, who has close contact for longer than 15 cumulative minutes in a day with a person who has COVID-19. Schools should work with their LPHAs to establish who was exposed, and follow the LPHA's determination of what is an

exposure. If a student or staff member is diagnosed with COVID-19, then the LPHA should be consulted to review the situation. **If a school cannot confirm that 6 feet of distancing was consistently maintained or 3 foot distancing with consistent mask use was maintained during the school day, then each person the confirmed case was in contact with will need to quarantine** – this could include all members of a stable cohort.

Students should not be placed into full-time cohort groups based on any demographic or disability criteria (e.g., students with complex medical needs, students with IEPs, students receiving language services, etc.). Schools should consider creating small groups within cohorts around skills and instructional needs. For example, a small instructional math group can be organized that is diverse by demographics, any disability criteria, speech/language services, or English language development.

Ventilation and Airflow

Ventilation is a primary tool to reduce viral spread indoors and promote a healthy learning environment. Indoor air spaces need special consideration because of potential COVID-19 transmission from the buildup in air of smaller particles and aerosols that are generated from breathing, talking, laughing, shouting, singing, coughing, and sneezing. While a properly fitting face covering or mask can limit the release of most respiratory droplets and aerosols, smaller particles or aerosols that pass through can remain airborne for minutes to hours, depending on ventilation, humidity, and other factors.

ODE and OHA *strongly advise* schools to ensure effective ventilation and improve the indoor air quality in schools by:

1. Increasing the amount of fresh outside air that is introduced into the system;
2. Exhausting air from indoors to the outdoors; and
3. Cleaning the air that is recirculated indoors with effective filtration methods (e.g., HEPA filters) to remove virus-containing particles from the air.

Poor ventilation of indoor settings, particularly those with larger numbers of people, significantly increases transmission risk of COVID-19.

All ventilation strategies should include safety and health precautions including restricting the amount a window is open, putting screens in windows and covers on fans, and adjusting the thermostat to maintain a comfortable temperature.

In addition, improved indoor air quality is associated with better student and staff attendance, engagement, and well-being, as well as other health outcomes, including reduced asthma and allergies. Optimization of school indoor air quality can provide benefits extending beyond mitigating communicable disease transmission. CDC Guidance on Ventilation in schools.

Ventilation

- Increase outdoor ventilation of clean air into indoor spaces. Open windows and doors unless doing so creates a health or safety risk. Consider conducting some activities, meals, and classes outside when reasonable.
- Use fans to help move indoor air out open windows.
  - Consider placing a fan securely in a window to efficiently move air from the indoors to the outdoors.
  - Do not place fans so that air is moved directly from one person toward others.
- If a window air conditioner is installed, operate it to increase outdoor air intake. Ensure the vent is open if outdoor air quality is good.
- Always operate restroom exhaust fans when the building is occupied.
- Operate and maintain local exhaust ventilation systems in kitchens or cooking areas when these spaces are occupied. Consider operating local exhaust ventilation even when these spaces are not occupied to supplement ventilation for the building when other areas are occupied.
- If there will be changes in occupancy throughout the day, allow for breaks in between groups when possible so that the space can be "flushed" to remove pathogens in the air. Flushing can be best achieved by providing outdoor air (or equivalent clean air) by mechanical means, such as the fan in the HVAC system or a fan in an open window. Providing equivalent outdoor air can be done with a HEPA air cleaner. Open doors and windows when possible.
- Aim for fewer people in larger rooms if feasible. This will allow more distance between people and more space for air movement and dilution.

Air Purifiers to Improve Indoor Air Quality

One or more air filtering devices equipped with a HEPA filter can be used indoors. These would trap most particles they encounter. This would reduce exposure to viruses and other airborne microbes.

- Use portable HEPA filtering devices to supplement HVAC systems or in places where there is no HVAC system. This is especially valuable for higher risk areas such as a nurse's office or areas frequently occupied by persons with higher likelihood of COVID-19 and/or increased risk of getting COVID-19. Carefully locate air cleaning devices so the intake is unobstructed and the exhaust can move air as far away as possible before it is drawn into any HVAC system in the space.
  - The American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE) has issued the following resource: In-Room Air Cleaner Guidance for Reducing Covid-19 In Air In Your Space/Room
  - The Association of Home Appliance Manufacturers (AHAM) provides a list of Certified Room Air Cleaners. Check the clean air delivery rate (CADR) to see if it is suitable for the area of the room you are trying to clean.

- Avoid air cleaners that generate ozone or use devices that have been certified by the California Air Resources Board (CARB): List of CARB-Certified Air Cleaning Devices
- Unless air mixing patterns have been determined in an indoor space, place the cleaner in the center of the room/space or close to a person who might be talking rather than listening (e.g., a teacher in a classroom).

Heating, Ventilation, and Air Conditioning (HVAC) Systems

- Ensure HVAC systems operate properly and provide acceptable indoor air quality for the current occupancy level for each space. ASHRAE Standard 62.1 "specifies both minimum and recommended outdoor airflow rates to obtain acceptable indoor air quality for a variety of indoor spaces." Use the services of HVAC professionals to achieve the best performance from the existing HVAC system.
- Increase air filtration in HVAC systems to MERV 13 or better. Otherwise, aim for the highest possible rating that the system allows. HVAC professionals can help evaluate the potential to increase filtering efficiency. Additional steps include:
  - Inspecting filter housing and racks to ensure good fit of filters.
  - Ensuring air cannot flow around the filter and sealing gaps between filters and housing.
  - Replacing filters as recommended by manufacturer.
- Turn off any demand-controlled ventilation (DCV) that reduces air supply based on occupancy or temperature during occupied hours. Set the fan to the "on" position instead of "auto," which will operate the fan continuously, even when heating or air-conditioning is not required.

For additional resources, see OHA's guidance on indoor air considerations for COVID-19.

Handwashing and Respiratory Etiquette

Regular handwashing is one of the best ways to remove germs, avoid getting sick, and prevent the spread of germs to others. Washing hands can keep you healthy and prevent the spread of respiratory and diarrheal infections from one person to the next.

OHA and ODE *strongly advise* that schools create protocols and systems to ensure access to soap, water and alcohol-based hand sanitizer with at least 60% alcohol at the key times named below and that schools prioritize handwashing with soap and water after students or staff use the restroom.

Germs can spread from other people or surfaces when you:

- Touch your eyes, nose, and mouth with unwashed hands.
- Prepare or eat food and drinks with unwashed hands.
- Touch a contaminated surface or objects.

- Blow your nose, cough, or sneeze into hands and then touch other people's hands or common objects.

You can help your school and community stay healthy by ensuring that students and staff have access to soap, water and alcohol-based hand sanitizer with 60-96% alcohol and are encouraged and reminded to use these items. There are key times when you are likely to get and spread germs, and handwashing after these times is essential:

- Before, during, and after preparing food.
- Before and after eating food.
- Before and after caring for someone at home who is sick with COVID-19 symptoms, vomiting or diarrhea.
- Before and after treating a cut or wound.
- After using the toilet.
- After changing diapers or cleaning up a child who has used the toilet.
- After blowing your nose, coughing, or sneezing.
- After touching an animal, animal feed, or animal waste.
- After handling pet food or pet treats.
- After touching garbage.

All people on campus should be advised and encouraged to frequently wash their hands or use hand sanitizer. Remind students with signage and regular verbal reminders from staff of the critical nature of hand hygiene.

Remind students (with signage and regular verbal reminders from staff) of the importance of respiratory etiquette. Respiratory etiquette means covering coughs and sneezes with an elbow or a tissue. Tissues should be disposed of in a garbage can, then hands washed or sanitized immediately.

OHA Sponsored COVID-19 Testing in Schools

OHA and ODE strongly advise that schools implement COVID-19 testing.

There are two student and one staff opt-in COVID-19 testing programs available to all public and private schools in Oregon. OHA has created a comprehensive website for information on all school testing options. Please check out this easy to read screening and testing chart for a quick overview of the programs along with links to sign up.

Diagnostic Testing for K-12 Students and Staff

- *Using Abbott BinaxNOW rapid tests,* ***this program is intended to test symptomatic and exposed students and staff****. This essential access to free testing can help diagnose COVID-19 infection early and, when recommended by the local public health authority, may shorten the duration of quarantine for exposed students. Nearly all schools*

registered and participated in this program last year to great benefit. To participate this year, schools must register for the 2021-22 school year. To register or ask questions, please email schooltesting.COVID@DHSOHA.state.or.us.

Screening Testing for Unvaccinated K-12 Teachers/Staff

- *Screening testing is for individuals without symptoms of COVID-19 or exposure to COVID-19. Because COVID-19 vaccines are very effective in reducing the risk of infection, the CDC recommends screening only in unvaccinated individuals.* ***Staff may opt-in to this weekly screening program*** *where participation in the program and all results are confidential. However, positive COVID-19 results must be reported to the local public health authority for case investigation and contact tracing. These tests are self-administered at home and sent to a regional laboratory for processing. School staff can apply independently using this enrollment form. For questions, please contact COVIDscreening.Schools@dhsoha.state.or.us.*

Screening Testing for Unvaccinated Students

- *Screening testing is for individuals without symptoms of COVID-19 or exposure to COVID-19.* ***Both schools and families may opt-in for this weekly screening testing program*** *performed in collaboration with a regional laboratory partner. Participation in the program and all results are confidential. However, positive COVID-19 results must be reported to the local public health authority for case investigation and contact tracing. Program details vary by region and interested districts and schools may use this form for more information. For questions, please contact COVIDscreening.Schools@dhsoha.state.or.us.*

Public Health Communication and Training for School Staff

OHA and ODE *strongly advise* that school districts, charter schools, and private schools develop plans for communicating health and safety protocols to students, families and communities. Protocols may differ from school-to school. A strong communication plan that includes protocols for communicating potential COVID-19 cases to the school community and other stakeholders is critical. Provide clarity and supporting materials for communication to community members (in their preferred language) about the specific health and safety protocols in place at the school, and why these might differ from those of nearby schools or be different across school districts.

To support these efforts, ODE developed a communications toolkit to equip school and district leaders with tools they can use to initiate conversations and communication with staff, students, families, the media and the broader school community.

OHA and ODE *strongly advise* that school districts, charter schools, and private schools develop

plans for training all staff in their health and safety protocols and jointly develop lesson plans for instruction to students.

Consider forming a school committee to oversee the implementation of the health and safety protocols that is inclusive of represented and unrepresented staff. Ensure that all staff have a safe place to bring implementation questions and suggestions forward.

Communicable Disease Management Plan for COVID-19 Required by OAR 581-022-2220

FERPA allows schools to share personally identifiable information with local public health authorities (LPHAs) without consent when needed to respond to a health emergency. Schools should work with their local public health authority to ensure they are able to effectively respond to and control outbreaks through sharing of information, even without parental consent, when appropriate. Consult with district legal counsel for more clarification.

The communicable disease management plan exists to describe measures put in place to limit the spread of COVID-19 within the school setting.

Communicable disease management plans are required by OAR 581-022-2220.

OHA and ODE strongly advise school districts to develop their communicable disease management plan with involvement of teachers, staff, school health professionals including school nurses, parents and guardians and other community partners (for example, health centers). The Whole School, Whole Community, Whole Child model may be helpful to outline communicable disease management plan components, including policies and protocols.

OHA and ODE *strongly advise* that school communicable disease management plans (template available) include the following sections and information specific to COVID-19 control measures:

- Conduct a risk assessment as required by OSHA administrative rule OAR 437-001-0744(3)(g). OSHA has developed a risk assessment template.
- Update the written communicable disease management plan to specifically address prevention of the spread of COVID-19. Examples are located in the Oregon School Nurses Association (OSNA) COVID-19 Toolkit.
    - Review OSHA requirements for infection control plans to ensure that all required elements are covered by your communicable disease management plan, including making the plan available to employees at their workplace. Requirements are listed in OSHA administrative rule OAR 437-001-0744(3)(h). OSHA has developed a sample infection control plan.
- Designate a single point-person at each school to establish, implement, support and enforce COVID-19 health and safety measures. This role should be known to all staff in

the building with consistent ways for licensed and classified staff to access and voice concerns or needs.

- Include names of the LPHA staff, school nurses, and other medical experts who provided support and resources to the district/school policies and plans. Review relevant local, state, and national evidence to inform the plan.
- A system for maintaining daily logs for each student/cohort for the purposes of contact tracing. This system needs to be made in consultation with a school/district nurse or an LPHA official. Sample logs are available as a part of the Oregon School Nurses Association COVID-19 Toolkit.
- Protocol to notify and provide logs to the local public health authority (LPHA Directory by County) of any confirmed COVID-19 cases among students or staff, or when notified of a confirmed COVID-19 case among students or staff. Process to report to the LPHA any cluster of any illness among staff or students. Protocol to cooperate with the LPHA recommendations related to COVID-19 health protections and quarantine timelines.
    - Protocol to isolate any ill or exposed persons from physical contact with others. Required by OAR 581-022-2220.
    - Process to ensure that all itinerant and all district staff (maintenance, administrative, delivery, nutrition, and any other staff) who move between buildings keep a log or calendar with a running four-week history of their time in each school building and who they were in contact with at each site.
- Document policy or protocol differences for people who are fully vaccinated for COVID-19 versus those who are not fully vaccinated. The Oregon Bureau of Labor and Industries is a resource for employers on verification of COVID-19 vaccine status.

Additional information on communicable disease management in schools is available in Communicable Disease Guidance for Schools.

Isolation & Quarantine Protocols Required by OAR 581-022-2220 and Response to Outbreak

Definitions:

- **Isolation** separates people who have a contagious disease from people who are not sick.
- **Quarantine** separates and restricts the movement of people who were exposed to a contagious disease and could become infectious themselves to limit further spread of the disease.
- Health care and a designated space that is appropriately supervised and adequately equipped for providing first aid and isolating the sick or injured child are **required by OAR 581-022-2220**.

Isolation and quarantine are core components under the authority of public health (LPHAs and OHA) as described in **ORS 431A.010, 433.004, 433.441**, and **433.443**. Schools and districts must cooperate with any LPHA investigations and requirements to protect the public health. LPHAs follow statewide Investigative Guidelines for COVID-19 and other diseases.

OHA and ODE *strongly advise* that isolation and quarantine protocols include the following:

- Exclusion and isolation protocols for sick students and staff identified at the time of arrival or during the school day. See the COVID-19 Exclusion Summary Guide.
- Offer free, on-site COVID-19 testing to students and staff with COVID-19 symptoms or exposure via OHA's K-12 school testing program.
- Protocols for safely transporting anyone who is sick to their home or to a healthcare facility.
- Adherence to school exclusion processes as laid out in Communicable Disease Guidance for Schools.
- Involvement of school nurses, School Based Health Centers, or staff with related experience (occupational or physical therapists) in development of protocols and assessment of symptoms (where staffing exists).
- Recording and monitoring the students and staff being isolated or sent home for the LPHA review.

OHA and ODE *strongly advise* that Response to Outbreak protocols include the following:

- Reviewing and using the "Planning for COVID-19 Scenarios in Schools" toolkit.
- Coordination with local public health authority (LPHA) to establish communication channels related to current transmission level.
- Means by which school will ensure continuous education services for students and supports for staff.
- Means by which school will continue to provide meals for students.
- Cleaning surfaces (e.g. door handles, sink handles, drinking fountains, transport vehicles) following CDC guidance.

If you have any questions about the Resiliency Framework, please email the ODE COVID-19 inbox at ODECOVID19@ode.state.or.us.

Where to Go for More Information

Oregon School Nurse Association COVID-19 Toolkit

ODE's Supports for Continuity of Services webpage

The Centers for Disease Control and Prevention has additional information on:

- School workers
- Nutrition and food service
- Sports and other Extracurricular activities
- Visitors
- Recess and Physical Education

For **reference purposes only**, the Ready Schools, Safe Learners Guidance version 7.5.2 and many additional documents remain on the ODE website.

Exhibit O

Carbon Dioxide
Health Hazard Information Sheet

What is carbon dioxide?

Carbon dioxide (CO_2) is a colorless, odorless, non-flammable gas that naturally occurs in the atmosphere. CO_2 is produced by body metabolism and is a normal component of exhaled breath. It also results from the burning of fossil fuels and natural sources such as volcanic eruptions. CO_2 levels in outdoor air typically range from 300 to 400 ppm (0.03% to 0.04%) but can be as high as 600-900 ppm in metropolitan areas. Although it is most commonly present as a gas, CO_2 can also exist in a solid (dry ice) form.

How are FSIS employees exposed to carbon dioxide?

The most common exposure to CO_2 for FSIS employees results from the off-gassing of CO_2 gas from the use of dry ice for chilling and packing product. Dry ice is also sometimes blended with meat product. CO_2 levels directly next to an open bin of dry ice can be as high as 11,000 to 13,000 ppm. When dry ice is used in rooms without adequate ventilation CO_2 has been measured as high as 25,000 to 30,000 ppm. However, levels at poultry plant inspection stations range from about 900 to 3,500 ppm (depending on how close the inspection station is to the dry ice use). In a few cases elevated levels, in excess of 5,000 ppm have been found at inspection stations.

CO_2 gas is also used to euthanize both poultry and swine. This process is typically fully contained and CO_2 is vented to the atmosphere (outside the building). In some cases, compressed CO_2 gas is added to plant water (eg. chillers) to make carbonic acid for pH regulation. CO_2 is denser than air and can collect in high concentrations in open pits, low lying areas and confined spaces where it can displace oxygen creating a serious health hazard.

What are the health effects of carbon dioxide?

CO_2 is considered to be minimally toxic by inhalation. The primary health effects caused by CO_2 are the result of its behavior as a simple asphyxiant. A simple asphyxiant is a gas which reduces or displaces the normal oxygen in breathing air.

Symptoms of mild CO_2 exposure may include headache and drowsiness. At higher levels, rapid breathing, confusion, increased cardiac output, elevated blood pressure and increased arrhythmias may occur.

Breathing oxygen depleted air caused by extreme CO_2 concentrations can lead to death by suffocation.

What are the symptoms of different levels of exposure?

5,000 ppm (0.5%)	OSHA Permissible Exposure Limit (PEL) and ACGIH Threshold Limit Value (TLV) for 8-hour exposure

Exhibit O

10,000 ppm (1.0%)	Typically no effects, possible drowsiness
15,000 ppm (1.5%)	Mild respiratory stimulation for some people
30,000 ppm (3.0%)	Moderate respiratory stimulation, increased heart rate and blood pressure, ACGIH TLV-Short Term
40,000 ppm (4.0%)	Immediately Dangerous to Life or Health (IDLH)
50,000 ppm (5.0%)	Strong respiratory stimulation, dizziness, confusion, headache, shortness of breath
80,000 ppm (8.0%)	Dimmed sight, sweating, tremor, unconsciousness, and possible death

The response to CO2 inhalation various greatly even in healthy individuals. The seriousness of the symptoms is dependent on the concentration of CO2 and the length of time a person is exposed. Since CO2 is odorless and does not cause irritation, it is considered to have poor warning properties. Fortunately, conditions from low to moderate exposures are generally reversible when a person is removed from a high CO2 environment.

Another health hazard caused by CO2 is frostbite by contact with solid CO2 (dry ice) and vapors off-gassing from dry ice. Precautions should be taken to prevent direct skin and eye contact with dry ice or with vessels/bins containing dry ice. Similar effects may occur from compressed CO2 gas as it is being released from a cylinder if it comes in contact with the skin or eyes. CO2 gas at room temperature will not injure the skin or eyes.

What OSHA standards and exposure guidelines apply?

OSHA has established a Permissible Exposure Limit (PEL) for CO2 of 5,000 parts per million (ppm) (0.5% CO2 in air) averaged over an 8-hour work day (time-weighted average or TWA.) The American Conference of Governmental Industrial Hygienists (ACGIH) recommends an 8-hour TWA Threshold Limit Value (TLV) of 5,000 ppm and a Ceiling exposure limit (not to be exceeded) of 30,000 ppm for a 10-minute period. A value of 40,000 is considered immediately dangerous to life and health (IDLH value).

The TLVs are intended to minimize the potential for asphyxiation and undue metabolic stress. The ACGIH TLV supporting document states that: "Based on the long-term exposure studies, even though the majority of references are concerned with studies on physically fit males in confined spaces, a TLV-TWA of 5,000 ppm, is recommended. This value provides a good margin of safety from asphyxiation and from undue metabolic stress provided normal amounts of oxygen are present in the inhaled air." The TLV-STEL is based on short-term studies which showed that "concentrations of 27,600 to 39,500 ppm produced increased pulmonary ventilation rates. Therefore, a TLV-STEL of 30,000 ppm is considered appropriate."

How are occupational exposures monitored or measured?

CO2 concentrations in air can be measured using detector tubes (for immediate short term samples) and passive indicator tubes or dosimeters (for longer TWA full or partial shift sampling). The primary OSHA method for the sampling and analysis of CO2 involves using a

gas sampling bag followed by gas chromatography or infrared spectrophotometry analysis. If you would like to arrange for CO2 monitoring at your workplace, please contact your district's Occupational Safety and Health Specialist.

What are the safety precautions protect for carbon dioxide?

Employees should receive training and be knowledgeable of the potential sources and symptoms of exposure to CO2.

If you are working near any sources of dry ice and develop any of the symptoms of exposure, move to an area of fresh air immediately, and report the incident to your supervisor. (Fresh air or oxygen is the primary remedy for CO2 exposure.

If you are pregnant consult with your supervisor and your physician about limiting exposure to CO2.

If CO2 is used to euthanize poultry or livestock ensure that you are aware of the location of the gas sources and emission vents, alarm signals and any special precautions for working in those areas.

Do not enter areas where CO2 levels exceed 20,000 ppm until ventilation has been provided to bring the concentration down to safe levels.

Do not stand directly next to open bins that contain dry ice or in vapors from these bins. Do not touch dry ice or a bin containing dry ice.

How should training for this Health Hazard Information Sheet be recorded?

Per requirements found in FSIS Directive 4791.1 Section IX, all occupational health and safety training is to be recorded using either AgLearn or FSIS form 3530-12. Training records are to include the topics covered, date, and employee name. The Agency is to retain all training records for a minimum of five years."

Resources

For more information, see the OSHA website:
https://www.osha.gov/dts/chemicalsampling/data/CH_225400.html

About the ESHG

The FSIS Environmental Safety and Health Group (ESHG) is devoted to providing a safe and healthful work environment for FSIS employees. More information on safety topics can be found on the intranet site http://www.tinyurl.com/FSIS-ESHG or by email askemployeesafety@fsis.usda.gov

Exhibit P

https://www.cdc.gov/regulations/index.html

CDC Regulations

Related Links

- HHS Regulations
- Federal Government Regulations
- Regulations Information
- Federal Register
- HHS Unified Agenda

CDC's role in rules and regulations

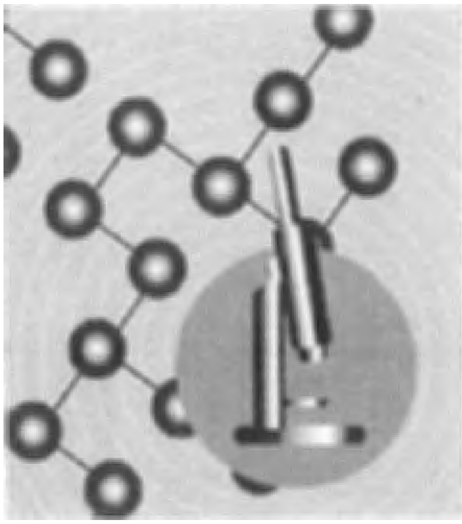
As the nation's public health protection agency, CDC has certain authorities to implement regulations related to protecting America from health and safety threats, both foreign and within the United States, and increasing public health security.

CDC and other agencies implement public health laws passed by Congress through Federal Regulations. After a Congressional bill becomes law, federal agencies may be responsible for putting the law into action through the development of regulations—also known as "rules." Federal regulations give the public details or specific requirements of how the law will be applied. The process of creating regulations or rules is called rulemaking.

Exhibit P

Exhibit Q

INDUSTRIAL HYGIENE



. . . "that science and art devoted to the anticipation, recognition, evaluation, and control of those environmental factors or stresses arising in or from the workplace, which may cause sickness, impaired health and well-being, or significant discomfort among workers or among the citizens of the community."

Exhibit Q

These materials were developed by OSHA's Office of Training and Education and are intended to assist employers, workers, and others as they strive to improve workplace health and safety. While we attempt to thoroughly address specific topics, it is not possible to include discussion of everything necessary to ensure a healthy and safe working environment in a presentation of this nature. Thus, this information must be understood as a tool for addressing workplace hazards, rather than an exhaustive statement of an employer's legal obligations, which are defined by statute, regulations, and standards. Likewise, to the extent that this information references practices or procedures that may enhance health or safety, but which are not required by a statute, regulation, or standard, it cannot, and does not, create additional legal obligations. Finally, over time, OSHA may modify rules and interpretations in light of new technology, information, or circumstances; to keep apprised of such developments, or to review information on a wide range of occupational safety and health topics, you can visit OSHA's website at www.osha.gov.

INTRODUCTION

Industrial hygiene has been defined as "that science and art devoted to the anticipation, recognition, evaluation, and control of those environmental factors or stresses arising in or from the workplace, which may cause sickness, impaired health and well-being, or significant discomfort among workers or among the citizens of the community." Industrial hygienists use environmental monitoring and analytical methods to detect the extent of worker exposure and employ engineering, work practice controls, and other methods to control potential health hazards.

There has been an awareness of industrial hygiene since antiquity. The environment and its relation to worker health was recognized as early as the fourth century BC when Hippocrates noted lead toxicity in the mining industry. In the first century AD, Pliny the Elder, a Roman scholar, perceived health risks to those working with zinc and sulfur. He devised a face mask made from an animal bladder to protect workers from exposure to dust and lead fumes. In the second century AD, the Greek physician, Galen, accurately described the pathology of lead poisoning and also recognized the hazardous exposures of copper miners to acid mists.

In the Middle Ages, guilds worked at assisting sick workers and their families. In 1556, the German scholar, Agricola, advanced the science of industrial hygiene even further when, in his book *De Re Metallica*, he described the diseases of miners and prescribed preventive measures. The book included suggestions for mine ventilation and worker protection, discussed mining accidents, and described diseases associated with mining occupations such as silicosis.

Industrial hygiene gained further respectability in 1700 when Bernardo Ramazzini, known as the "father of industrial medicine," published in Italy the first comprehensive book on industrial medicine, *De Morbis Artificum Diatriba (The Diseases of Workmen)*. The book contained accurate descriptions of the occupational diseases of most of the workers of his time. Ramazzini greatly affected the future of industrial hygiene because he asserted that occupational diseases should be studied in the work environment rather than in hospital wards.

Industrial hygiene received another major boost in 1743 when Ulrich Ellenborg published a pamphlet on occupational diseases and injuries among gold miners. Ellenborg also wrote about the toxicity of carbon monoxide, mercury, lead, and nitric acid.

In England in the 18th century, Percival Pott, as a result of his findings on the insidious effects of soot on chimney sweepers, was a major force in getting the British Parliament to pass the *Chimney-Sweepers Act of 1788*. The passage of the English Factory Acts beginning in 1833 marked the first effective legislative acts in the field of industrial safety. The Acts, however, were intended to provide compensation for accidents rather than to control their causes. Later, various other European nations developed workers' compensation acts, which stimulated the adoption of increased factory safety precautions and the establishment of medical services within industrial plants.

In the early 20th century in the U.S., Dr. Alice Hamilton led efforts to improve industrial hygiene. She observed industrial conditions first hand and startled mine owners, factory managers, and state officials with evidence that there was a correlation between

worker illness and exposure to toxins. She also presented definitive proposals for eliminating unhealthful working conditions.

At about the same time, U.S. federal and state agencies began investigating health conditions in industry. In 1908, public awareness of occupationally related diseases stimulated the passage of compensation acts for certain civil employees. States passed the first workers' compensation laws in 1911. And in 1913, the New York Department of Labor and the Ohio Department of Health established the first state industrial hygiene programs. All states enacted such legislation by 1948. In most states, there is some compensation coverage for workers contracting occupational diseases.

The U.S. Congress has passed three landmark pieces of legislation related to safeguarding workers' health: (1) the *Metal and Nonmetallic Mines Safety Act of 1966*, (2) the *Federal Coal Mine Safety and Health Act of 1969*, and (3) the *Occupational Safety and Health Act of 1970 (OSH Act)*. Today, nearly every employer is required to implement the elements of an industrial hygiene and safety, occupational health, or hazard communication program and to be responsive to the Occupational Safety and Health Administration (OSHA) and its regulations.

OSHA AND INDUSTRIAL HYGIENE

Under the *OSH Act*, OSHA develops and sets mandatory occupational safety and health requirements applicable to the more than 6 million workplaces in the U.S. OSHA relies on, among many others, industrial hygienists to evaluate jobs for potential health hazards. Developing and setting mandatory occupational safety and health standards involves determining the extent of employee exposure to hazards and deciding what is needed to control these hazards to protect workers. Industrial hygienists are trained to anticipate, recognize, evaluate, and recommend controls for environmental and physical hazards that can affect the health and well-being of workers.

More than 40 percent of the OSHA compliance officers who inspect America's workplaces are industrial hygienists. Industrial hygienists also play a major role in developing and issuing OSHA standards to protect workers from health hazards associated with toxic chemicals, biological hazards, and harmful physical agents. They also provide technical assistance and support to the agency's national and regional offices. OSHA also employs industrial hygienists who assist in setting up field enforcement procedures, and who issue technical interpretations of OSHA regulations and standards.

Industrial hygienists analyze, identify, and measure workplace hazards or stresses that can cause sickness, impaired health, or significant discomfort in workers through chemical, physical, ergonomic, or biological exposures. Two roles of the OSHA industrial hygienist are to spot those conditions and help eliminate or control them through appropriate measures.

WORKSITE ANALYSIS

A worksite analysis is an essential first step that helps an industrial hygienist determine what jobs and work stations are the sources of potential problems. During the worksite analysis, the industrial hygienist measures and identifies exposures, problem

tasks, and risks. The most-effective worksite analyses include all jobs, operations, and work activities. The industrial hygienist inspects, researches, or analyzes how the particular chemicals or physical hazards at that worksite affect worker health. If a situation hazardous to health is discovered, the industrial hygienist recommends the appropriate corrective actions.

RECOGNIZING AND CONTROLLING HAZARDS

Industrial hygienists recognize that engineering, work practice, and administrative controls are the primary means of reducing employee exposure to occupational hazards.

Engineering controls minimize employee exposure by either reducing or removing the hazard at the source or isolating the worker from the hazard. Engineering controls include eliminating toxic chemicals and substituting non-toxic chemicals, enclosing work processes or confining work operations, and the installation of general and local ventilation systems.

Work practice controls alter the manner in which a task is performed. Some fundamental and easily implemented work practice controls include (1) changing existing work practices to follow proper procedures that minimize exposures while operating production and control equipment; (2) inspecting and maintaining process and control equipment on a regular basis; (3) implementing good housekeeping procedures; (4) providing good supervision; and (5) mandating that eating, drinking, smoking, chewing tobacco or gum, and applying cosmetics in regulated areas be prohibited.

Administrative controls include controlling employees' exposure by scheduling production and tasks, or both, in ways that minimize exposure levels. For example, the employer might schedule operations with the highest exposure potential during periods when the fewest employees are present.

When effective work practices or engineering controls are not feasible or while such controls are being instituted, appropriate **personal protective equipment** must be used. Examples of personal protective equipment are gloves, safety goggles, helmets, safety shoes, protective clothing, and respirators. To be effective, personal protective equipment must be individually selected, properly fitted and periodically refitted; conscientiously and properly worn; regularly maintained; and replaced, as necessary.

EXAMPLES OF JOB HAZARDS

To be effective in recognizing and evaluating on-the-job hazards and recommending controls, industrial hygienists must be familiar with the hazards' characteristics. Potential hazards can include air contaminants, and chemical, biological, physical, and ergonomic hazards.

Air Contaminants

These are commonly classified as either particulate or gas and vapor contaminants. The most common particulate contaminants include dusts, fumes, mists, aerosols, and fibers.

Dusts are solid particles generated by handling, crushing, grinding, colliding, exploding, and heating organic or inorganic materials such as rock, ore, metal, coal, wood, and grain

Fumes are formed when material from a volatilized solid condenses in cool air. In most cases, the solid particles resulting from the condensation react with air to form an oxide.

The term **mist** is applied to liquid suspended in the atmosphere. Mists are generated by liquids condensing from a vapor back to a liquid or by a liquid being dispersed by splashing or atomizing. **Aerosols** are also a form of a mist characterized by highly respirable, minute liquid particles.

Fibers are solid particles whose length is several times greater than their diameter, such as asbestos.

Gases are formless fluids that expand to occupy the space or enclosure in which they are confined. They are atomic, diatomic, or molecular in nature as opposed to droplets or particles which are made up of millions of atoms or molecules. Through evaporation, liquids change into vapors and mix with the surrounding atmosphere. **Vapors** are the volatile form of substances that are normally in a solid or liquid state at room temperature and pressure. Vapors are gases in that true vapors are atomic or molecular in nature.

Chemical Hazards

Harmful chemical compounds in the form of solids, liquids, gases, mists, dusts, fumes, and vapors exert toxic effects by inhalation (breathing), absorption (through direct contact with the skin), or ingestion (eating or drinking). Airborne chemical hazards exist as concentrations of mists, vapors, gases, fumes, or solids. Some are toxic through inhalation and some of them irritate the skin on contact; some can be toxic by absorption through the skin or through ingestion, and some are corrosive to living tissue.

The degree of worker risk from exposure to any given substance depends on the nature and potency of the toxic effects and the magnitude and duration of exposure. Information on the risk to workers from chemical hazards can be obtained from the Material Safety Data Sheet (MSDS) that OSHA's *Hazard Communication Standard* requires be supplied by the manufacturer or importer to the purchaser of all hazardous materials. The MSDS is a summary of the important health, safety, and toxicological information on the chemical or the mixture's ingredients. Other provisions of the Hazard Communication Standard require that all containers of hazardous substances in the workplace have appropriate warning and identification labels.

Biological Hazards

These include bacteria, viruses, fungi, and other living organisms that can cause acute and chronic infections by entering the body either directly or through breaks in the skin.

Occupations that deal with plants or animals or their products or with food and food processing may expose workers to biological hazards. Laboratory and medical personnel also can be exposed to biological hazards. Any occupations that result in contact with bodily fluids pose a risk to workers from biological hazards.

In occupations where animals are involved, biological hazards are dealt with by preventing and controlling diseases in the animal population as well as properly caring for and handling infected animals. Also, effective personal hygiene, particularly proper attention to minor cuts and scratches especially on the hands and forearms, helps keep worker risks to a minimum.

In occupations where there is potential exposure to biological hazards, workers should practice proper personal hygiene, particularly hand washing. Hospitals should provide proper ventilation, proper personal protective equipment such as gloves and respirators, adequate infectious waste disposal systems, and appropriate controls including isolation in instances of particularly contagious diseases such as tuberculosis.

Physical Hazards

These include excessive levels of ionizing and nonionizing electromagnetic radiation, noise, vibration, illumination, and temperature.

In occupations where there is exposure to ionizing radiation, **time**, **distance**, and **shielding** are important tools in ensuring worker safety. Danger from radiation increases with the amount of time one is exposed to it; hence, the shorter the time of exposure the smaller the radiation danger.

Distance also is a valuable tool in controlling exposure to both ionizing and nonionizing radiation. Radiation levels from some sources can be estimated by comparing the squares of the distances between the worker and the source. For example, at a reference point of 10 feet from a source, the radiation is 1/100 of the intensity at 1 foot from the source.

Shielding also is a way to protect against radiation. The greater the protective mass between a radioactive source and the worker, the lower the radiation exposure.

In some instances, however, limiting exposure to or increasing distance from certain forms of nonionizing radiation, such as lasers, is not effective. For example, an exposure to laser radiation that is faster than the blinking of an eye can be hazardous and would require workers to be miles from the laser source before being adequately protected. Shielding workers from this source can be an effective control method.

Noise, another significant physical hazard, can be controlled by various measures. Noise can be reduced by installing equipment and systems that have been engineered, designed, and built to operate quietly; by enclosing or shielding noisy equipment; by making certain that equipment is in good repair and properly maintained with all worn or unbalanced parts replaced; by mounting noisy equipment on special mounts to reduce vibration; and by installing silencers, mufflers, or baffles.

Substituting quiet work methods for noisy ones is another significant way to reduce

noise-for example, welding parts rather than riveting them. Also, treating floors, ceilings, and walls with acoustical material can reduce reflected or reverberant noise. In addition, erecting sound barriers at adjacent work stations around noisy operations will reduce worker exposure to noise generated at adjacent work stations.

It is also possible to reduce noise exposure by increasing the distance between the source and the receiver, by isolating workers in acoustical booths, limiting workers' exposure time to noise, and by providing hearing protection. OSHA requires that workers in noisy surroundings be periodically tested as a precaution against hearing loss.

Another physical hazard, radiant heat exposure in factories such as steel mills, can be controlled by installing reflective shields and by providing protective clothing.

Ergonomic Hazards

The science of ergonomics studies and evaluates a full range of tasks including, but not limited to, lifting, holding, pushing, walking, and reaching. Many ergonomic problems result from technological changes such as increased assembly line speeds, adding specialized tasks, and increased repetition; some problems arise from poorly designed job tasks. Any of those conditions can cause ergonomic hazards such as excessive vibration and noise, eye strain, repetitive motion, and heavy lifting problems. Improperly designed tools or work areas also can be ergonomic hazards. Repetitive motions or repeated shocks over prolonged periods of time as in jobs involving sorting, assembling, and data entry can often cause irritation and inflammation of the tendon sheath of the hands and arms, a condition known as carpal tunnel syndrome.

Ergonomic hazards are avoided primarily by the effective design of a job or jobsite and by better designed tools or equipment that meet workers' needs in terms of physical environment and job tasks. Through thorough worksite analyses, employers can set up procedures to correct or control ergonomic hazards by using the appropriate engineering controls (e.g., designing or redesigning work stations, lighting, tools, and equipment); teaching correct work practices (e.g., proper lifting methods); employing proper administrative controls (e.g., shifting workers among several different tasks, reducing production demand, and increasing rest breaks); and, if necessary, providing and mandating personal protective equipment. Evaluating working conditions from an ergonomics standpoint involves looking at the total physiological and psychological demands of the job on the worker.
Overall, industrial hygienists point out that the benefits of a well-designed, ergonomic work environment can include increased efficiency, fewer accidents, lower operating costs, and more effective use of personnel.

In sum, industrial hygiene encompasses a broad spectrum of the working environment. Early in its history, OSHA recognized industrial hygiene as an integral part of a healthful work setting. OSHA places a high priority on using industrial hygiene concepts in its health standards and as a tool for effective enforcement of job safety and health regulations. By recognizing and applying the principles of industrial hygiene to the work environment, America's workplaces will become more healthful and safer.

5:35 AM Fri Oct 22 48%

Exhibit R

web.archive.org

industrial Exhibits and... Twitter U.S. Surgeo... I love you on Twitter: "...

https://twitter.com/Surgeon_General/status/1233725785283932160?ref_src=twsrc%5Etfw

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167 captures

MAR 01 2020 APR 2021

About this capture

U.S. Surgeon General @Surgeon_General

Follow

Seriously people- STOP BUYING MASKS!

They are NOT effective in preventing general public from catching #Coronavirus, but if healthcare providers can't get them to care for sick patients, it puts them and our communities at risk!

3:08 AM · 29 Feb 2020

35,016 Retweets 57,365 Likes

4.9K 25K 57K

U.S. Surgeon General @Surgeon_General · Feb 29

The best way to protect yourself and your community is with everyday preventive actions, like staying home when you are sick and washing hands with soap and water, to help slow the spread of respiratory illness.
Get your #FluShot- fewer flu patients = more resources for #COVID19

472 3.6K 7.2K

Go Sox @Go_BoSox · Feb 29

Replying to @Surgeon_General @IngrahamAngle

So when the public uses them, they don't work, so don't buy them.

Besides we need them for health care workers, because they will get sick without them.

This doesn't add up.

203 177 2.7K

Exhibit R

How Can You "Follow The Science" When There Is "No Science Behind Mask Mandates For Children"?

CDC Ignores Research, Or Lack Thereof, And Recommends Mask Mandates For Students In Schools

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"AMBITIOUS AND GROUNDBREAKING" CDC STUDY FINDS "NULL EFFECTS" OF MASK MANDATES IN SCHOOLS

A May 2021 Study From The CDC Found That Incidence Of COVID-19 For Students In Schools Mandating Masks "Was Not Statistically Significant Compared With Schools Where Mask Use Was Optional." "The 21% lower incidence in schools that required mask use among students was not statistically significant compared with schools where mask use was optional. This finding might be attributed to higher effectiveness of masks among adults, who are at higher risk for SARS-CoV-2 infection but might also result from differences in mask-wearing behavior among students in schools with optional requirements." (Jenna Gettings, DVM; Michaila Czarnik, MPH; Elana Morris, MPH; Elizabeth Haller, MEd; Angela M. Thompson-Paul, PhD; Catherine Rasberry, PhD; Tatiana M. Lanzieri, MD; Jennifer Smith-Grant, MSPH; Tiffiany Michelle Aholou, PhD; Ebony Thomas, MPH; Cherie Drenzek, DVM; Duncan MacKellar, DrPH; "Mask Use and Ventilation Improvements to Reduce COVID-19 Incidence in Elementary Schools — Georgia, November 16-December 11, 2020," U.S. Centers for Disease Control and Prevention's Morbidity and Mortality Weekly Report, 5/21/21)

- **The CDC's "Ambitious And Groundbreaking" Study Covered More Than 90,000 Georgia Students Who Attended 169 Schools, Some With Mask Mandates And Some Without.** "The study published by the CDC was both ambitious and groundbreaking. It covered more than 90,000 elementary-school students in 169 Georgia schools from November 16 to December 11 and was, according to the CDC, the first of its kind to compare COVID-19 incidence in schools with certain mitigation measures in place to other schools without those measures." (David Zweig, "The Science of Masking Kids at School Remains Uncertain," *New York Magazine's Intelligencer*, 8/20/21)

Scientists: CDC's Omission of Findings "Amounted to 'File Drawering'"

Scientists Accused The CDC of Burying The Study's Finding Of "Null Effects Of A Student Masking Requirement" By Leaving It Out Of The Study's Summary. "Scientists I spoke with believe that the decision not to include the null effects of a student masking requirement (and distancing, hybrid models, etc.) in the summary amounted to 'file drawering' these findings, a term researchers use for the practice of burying studies that don't produce statistically significant results." (David Zweig, "The Science of Masking Kids at School Remains Uncertain," *New York Magazine's Intelligencer*, 8/20/21)

Exhibit S

- **Vinay Prasad, Associate Professor In University Of California, San Francisco's Department Of Epidemiology And Biostatistics: "It Should Have Been Included In The Summary."** "'That a masking requirement of students failed to show independent benefit is a finding of consequence and great interest,' says Vinay Prasad, an associate professor in University of California, San Francisco's Department of Epidemiology and Biostatistics. 'It should have been included in the summary.'" (David Zweig, "The Science of Masking Kids at School Remains Uncertain," *New York Magazine's Intelligencer*, 8/20/21)

- **Tracy Hoeg, An Epidemiologist And Associate Researcher At The University Of California, Davis: "The Summary Gives The Impression That Only Masking Of Staff Was Studied, When In Reality There Was This Additional Important Detection About A Student-Masking Requirement Not Having A Statistical Impact."** "'The summary gives the impression that only masking of staff was studied,' says Tracy Hoeg, an epidemiologist and the senior author of a separate CDC study on COVID-19 transmission in schools, 'when in reality there was this additional important detection about a student-masking requirement not having a statistical impact.'" (David Zweig, "The Science of Masking Kids at School Remains Uncertain," *New York Magazine's Intelligencer*, 8/20/21)

About Two Months Later, The CDC Ignores Its Own Study, Recommends "Universal Indoor Masking" In Schools

The CDC Recommends "Universal Indoor Masking" For Students In School. "CDC recommends universal indoor masking for all teachers, staff, students, and visitors to K-12 schools, regardless of vaccination status." ("Guidance for COVID-19 Prevention in K-12 Schools," U.S. Centers for Disease Control and Prevention, 8/5/21, Accessed 8/30/21)

The American Academy Of Pediatrics Issued Guidance In July That "All Students Older Than 2 Years Old…Should Wear Face Masks At School." "All students older than 2 years and all school staff should wear face masks at school (unless medical or developmental conditions prohibit use)." ("COVID-19 Guidance for Safe Schools," American Academy of Pediatrics, Accessed 8/30/21)

While AAP, CDC Use Silence And Misdirection When Pressed On Recommendations, "Many Experts" More Open And Direct

In Response To A Reporter's Request For "Underlying Data" To Support Their Recommendation For Universal Masking In Schools, AAP "Did Not Respond" And The CDC "Links To Unrelated Materials On Vaccines And A Recent Outbreak Among Adults." "After the CDC and the American Academy of Pediatrics issued their student-mask guidance last month, I contacted both organizations asking for the evidence or underlying data upon which they had based their recommendations. The AAP did not respond to multiple requests. The CDC press office replied that since children under 12 cannot be vaccinated, the agency 'recommends schools do universal masking' and included links to unrelated materials on vaccines and a recent outbreak

among adults." (David Zweig, "The Science of Masking Kids at School Remains Uncertain," New York Magazine's Intelligencer, 8/20/21)

After Consulting "Many Experts," "Nobody Was Able To Find A Data Set As Robust As The Georgia Results — That Is, A Large Cohort Study Directly Looking At The Effects Of A Mask Requirement." "Over the course of several weeks, I also corresponded with many experts — epidemiologists, infectious-disease specialists, an immunologist, pediatricians, and a physician publicly active in matters relating to COVID — asking for the best evidence they were aware of that mask requirements on students were effective. Nobody was able to find a data set as robust as the Georgia results — that is, a large cohort study directly looking at the effects of a mask requirement." (David Zweig, "The Science of Masking Kids at School Remains Uncertain," New York Magazine's Intelligencer, 8/20/21)

SCIENTISTS, DOCTORS, RESEARCHERS FIND "NO SCIENCE BEHIND MASK MANDATES FOR CHILDREN"

Dr. Marty Makary And Dr. H. Cody Meissner: "There's No Science Behind Mask Mandates For Children." "We have been encouraging Americans to wear masks since the beginning of the pandemic. But special attention should be paid to the many children who struggle with masks. Public-health officials claim to base their decisions and guidance on science, but there's no science behind mask mandates for children." (Marty Makary and H. Cody Meissner, "The Case Against Masks for Children," The Wall Street Journal, 8/8/21)

- **Dr. Marty Makary Is A Professor At Johns Hopkins School Of Medicine.** (Profile of Martin Adel Makary, M.D., M.P.H., Johns Hopkins Medicine website, Accessed 8/30/21)

- **Dr. H. Cody Meissner Is Chief Of Pediatric Infectious Disease At Tufts Children's Hospital And A Professor Of Pediatrics At Tufts University School Of Medicine.** (Profile of H. Cody Meissner, M.D., Tufts Children's Hospital Website, Accessed 8/30/21)

Dr. Vinay Prasad, M.D., M.P.H., And Associate Professor Of Medicine At The University Of California San Francisco: "The CDC Cannot 'Follow The Science' Because There Is No Relevant Science." "The CDC cannot 'follow the science' because there is no relevant science. The proposition is at best science-y; a best guess based on political pressure, pundit anxiety, and mechanistic understanding." (Vinay Prasad, "What's the Evidence Guiding CDC's Latest Mask Policy?" Medpage Today, 7/29/21)

- **Dr. Prasad: "We Have Learned Next To Nothing" About The Efficacy Of Mask Mandates.** "When it comes to non-pharmacologic interventions such as mandatory business closures, mask mandates, and countless other interventions, the shocking conclusion of the last 18 months is this: We have learned next to nothing. Yet, here we are again with CDC changing its mind on masking, but what new evidence is guiding the policy?" (Vinay Prasad, "What's the Evidence Guiding CDC's Latest Mask Policy?" Medpage Today, 7/29/21)

Dr. Martin Kulldorff, Professor Of Medicine At Harvard Medical School: "No Scientific Evidence That Masking Children Is Effective." "Triple stumble by Fauci[:]

1. No scientific evidence that masking children is effective[;] 2. Even if effective, children have low disease risk, minuscule mortality risk and do not transmit much[;] 3. For the rare transmission, adults should get vaccinated; not demand masks on children https://twitter.com/tomselliott/status/1415006074483118085" (Martin Kulldorff, Twitter, 7/13/21)

- **Dr. Kulldorff: "Mandating Children To Wear Masks Is Detrimental To Their Health, And Claimed Benefits To Public Health Lack Scientific Evidence."** "Anthony Fauci is an immunologist, not an infectious disease epidemiologist, but happy to debate him. Mandating children to wear masks is detrimental to their health, and claimed benefits to public health lack scientific evidence. https://twitter.com/MartinKulldorff/status/1380902063136251904" (Martin Kulldorff, Twitter, 4/11/21)

Dr. Scott Balsitis, Ph.D., Viral Immunologist, And Former CDC Fellow: "No Data" To Support Universal Indoor Masking For Students. "True, in spite of having no data showing it works. Therein lies the problem. It doesn't matter how many people want something to be true, it matters if it is true. That's why most medical experts in many other countries are recommending against masking kids." (Scott J. Balsitis, Twitter, 8/27/21)

- **Dr. Balsitis: "We Now Have Three Studies On Masking Kids, And None Show A Significant Benefit."** "We now have three studies on masking kids, and none show a significant benefit. https://www.cdc.gov/mmwr/volumes/70/wr/mm7021e1.htm https://www.medrxiv.org/content/10.1101/2021.05.19.21257467v1.full https://meridian.allenpress.com/jat/article/doi/10.4085/1062-6050-0185.21/466422/Reported-COVID-19-Incidence-in-Wisconsin-High" (Scott J. Balsitis, Twitter, 8/26/21)

Dr. Lucy M. McBride, M.D. And Practicing Internist: "The Science Simply Isn't There To Support A Mandate" Of Masks In Schools. "In my opinion, we should not have mask mandates in schools, given that kids are at exceedingly low risk of complications from Covid-19, and more importantly the science simply isn't there to support a mandate." (Fiona Rutherford, "Schools Get CDC Leeway on Covid Limits to Keep Kids in Class," *Bloomberg*, 7/9/21)

- **Dr. McBride: "I Take Issue W/ Mask Mandates In Schools When The Science Isn't There."** "I take issue w/ mask mandates in schools when the science isn't there. IMHO the decision to mask should be up to the family, child, & peds MD based on the unique child/family medical/social/environm factors. Ex. a high-risk child or a child living w/ non-immune family might mask." (Lucy McBride, MD, Twitter, 7/9/21)

- **Dr. McBride: "There Isn't Any Solid Evidence That Masking Children Helps Reduce Covid Transmission. We Just Don't Have That Data."** (Fiona Rutherford, "Schools Get CDC Leeway on Covid Limits to Keep Kids in Class," *Bloomberg*, 7/9/21)

Dr. Elissa Schechter-Perkins, M.D., M.P.H.: "I'm Not Aware Of Any Studies That Show Conclusively That Kids Wearing Masks In Schools Has Any Effect On Their

Own Morbidity Or Mortality Or On The Hospitalization Or Death Rate In The Community Around Them." "'A year ago, I said, 'Masks are not the end of the world; why not just wear a mask?" Elissa Schechter-Perkins, the director of Emergency Medicine Infectious Disease Management at Boston Medical Center, told me. 'But the world has changed, there are real downsides to masking children for this long, with no known end date, and without any clear upside.' She continued, 'I'm not aware of any studies that show conclusively that kids wearing masks in schools has any effect on their own morbidity or mortality or on the hospitalization or death rate in the community around them.'" (David Zweig, "The Science of Masking Kids at School Remains Uncertain," *New York Magazine's Intelligencer*, 8/20/21)

- **Dr. Elissa Schechter-Perkins Is An Associate Professor Of Emergency Medicine At The Boston University School Of Medicine And The Director Of Emergency Medicine Infectious Disease Management At Boston Medical Center.** (Profile of Elissa M. Schechter-Perkins, MD, MPH, BU School of Medicine website, Accessed 8/30/21; David Zweig, "The Science of Masking Kids at School Remains Uncertain," *New York Magazine's Intelligencer*, 8/20/21)

Dr. Jeffrey Flier, M.D., Former Dean Of The Faculty Of Medicine At Harvard University: "We Lack Credible Evidence For Benefits Of Masking Kids Aged 2-5." "We lack credible evidence for benefits of masking kids aged 2-5. Despite what American Academy of Pediatrics says. @VPrasadMDMPH explains. https://twitter.com/VPrasadMDMPH/status/1417199553762119682" (Jeffrey Flier, Twitter, 7/19/21)

Study About Whether Masks Reduce Covid Transmission In Children Was "Inconclusive." "Do masks reduce Covid transmission in children? Believe it or not, we could find only a single retrospective study on the question, and its results were inconclusive." (Marty Makary and H. Cody Meissner, "The Case Against Masks for Children," *The Wall Street Journal*, 8/8/21)

Researchers And Doctors In Germany Conclude That "There Is A Lack Of Evidence For Widespread Use [Of Masks] In Children." "The effectiveness of masks in children as a viral protection is controversial, and there is a lack of evidence for their widespread use in children; this is also addressed in more detail by the scientists of the German University of Bremen in their thesis paper 2.0 and 3.0." (Kai Kisielinski, Paul Giboni, Andreas Prescher, Bernd Klosterhalfen, David Graessel, Stefan Funken, Oliver Kempski, and Oliver Hirsch, "Is a Mask That Covers the Mouth and Nose Free from Undesirable Side Effects in Everyday Use and Free of Potential Hazards?" *International Journal of Environmental Research and Public Health*, 4/21, 18(8): 4344)

- **Researchers And Doctors In Germany: "Further Research Is Particularly Desirable."** "For scientists, the prospect of continued mask use in everyday life suggests areas for further research. In our view, further research is particularly desirable in the gynecological (fetal and embryonic) and pediatric fields, as children are a vulnerable group that would face the longest and, thus, most profound consequences of a potentially risky mask use." (Kai Kisielinski, Paul Giboni, Andreas Prescher, Bernd Klosterhalfen, David Graessel, Stefan Funken, Oliver Kempski, and Oliver Hirsch, "Is a Mask That Covers the Mouth and Nose Free from Undesirable Side Effects in Everyday Use and Free of Potential Hazards?" *International Journal of Environmental Research and Public Health*, 4/21, 18(8): 4344)

Experts Indicate Mandating Masks In Schools "May Contribute Only A Marginal Benefit Or None At All." "Though the CDC says that layered mitigation in schools is effective, without studying each of the layers individually, it cannot know which of those measures work, and to what degree, and which don't. For example, several experts told me, it's entirely possible that open windows or fresh-air ventilation accounts for nearly all the mitigation benefit in a classroom and other 'layered' interventions may contribute only a marginal benefit or none at all." (David Zweig, "The Science of Masking Kids at School Remains Uncertain," *New York Magazine's Intelligencer*, 8/20/21)

Brown University Researchers Did "Not Find Any Correlations With Mask Mandates" And COVID-19 Case Rates Among Students. "This paper reports on the correlation of mitigation practices with staff and student COVID-19 case rates in Florida, New York, and Massachusetts during the 2020-2021 school year. We analyze data collected by the COVID-19 School Response Dashboard and focus on student density, ventilation upgrades, and masking. We find higher student COVID-19 rates in schools and districts with lower in-person density but no correlations in staff rates. Ventilation upgrades are correlated with lower rates in Florida but not in New York. We do not find any correlations with mask mandates. All rates are lower in the spring, after teacher vaccination is underway." (Emily Oster, Rebecca Jack, Clare Halloran, John Schoof, Diana McLeod, "COVID-19 Mitigation Practices and COVID-19 Rates in Schools: Report on Data from Florida, New York and Massachusetts," medRxiv, 5/21/21)

World Health Organization: Studies On Effectiveness Of Masking Students In School Are "Sparse." "Studies on the effects of risk-mitigation interventions in schools, such as limiting contact between children, wearing masks (outside or in classes continuously), closing areas and activities (play, sports, canteens) and enhancing ventilation, are sparse." (World Health Organization, "Schooling during COVID-19: recommendations from the European Technical Advisory Group for schooling during COVID-19," WHO Regional Office for Europe, 6/21)

But CDC Recommendations, News Headlines Ignore "Lack Of Evidence" On Masking Kids In School

"The Best Practices For Mask Use In Schools…Are Much Less Obvious Than CDC Guidance And News Headlines About Keeping Schools Safe Might Have You Believe." "But with tens of millions of American kids headed back to school in the fall, their parents and political leaders owe it to them to have a clear-sighted, scientifically rigorous discussion about which anti-COVID measures actually work and which might put an extra burden on vulnerable young people without meaningfully or demonstrably slowing the spread of the virus. In that context, the best practices for mask use in schools — elementary schools in particular — are much less obvious than CDC guidance and news headlines about keeping schools safe might have you believe." (David Zweig, "The Science of Masking Kids at School Remains Uncertain," *New York Magazine's Intelligencer*, 8/20/21)

SCIENTISTS, DOCTORS, RESEARCHERS FIND NEGATIVE IMPACTS OF MASKING CHILDREN

Experts Find Children Can Face "Psychological Harm" From Wearing Masks

Children Can Face "Psychological Harm" From Masking, Including "Robotic And Emotionless Interactions, Anxiety And Depression," According To Professors Of Medicine At Johns Hopkins University And Tufts University. "The possible psychological harm of widespread masking is an even greater worry. Facial expressions are integral to human connection, particularly for young children, who are only learning how to signal fear, confusion and happiness. Covering a child's face mutes these nonverbal forms of communication and can result in robotic and emotionless interactions, anxiety and depression. Seeing people speak is a building block of phonetic development. It is especially important for children with disabilities such as hearing impairment." (Marty Makary and H. Cody Meissner, "The Case Against Masks for Children," *The Wall Street Journal*, 8/8/21)

Mask Mandates In Schools Can Impact The "Psychological And Physical Development Of Healthy Children." "The long-term sociological, psychological and educational consequences of a comprehensive masking requirement extended to schools are also unpredictable with regard to the psychological and physical development of healthy children." (Kai Kisielinski, Paul Giboni, Andreas Prescher, Bernd Klosterhalfen, David Graessel, Stefan Funken, Oliver Kempski, and Oliver Hirsch, "Is a Mask That Covers the Mouth and Nose Free from Undesirable Side Effects in Everyday Use and Free of Potential Hazards?" *International Journal of Environmental Research and Public Health*, 4/21, 18(8): 4344)

Mask-Wearing Children May Face "Panic Attacks" And "Claustrophobic Fears." "In the field of pediatrics, special attention should also be paid to the mask symptoms described under psychological, psychiatric and sociological effects with possible triggering of panic attacks by CO2 rebreathing in the case of predisposition and also reinforcement of claustrophobic fears." (Kai Kisielinski, Paul Giboni, Andreas Prescher, Bernd Klosterhalfen, David Graessel, Stefan Funken, Oliver Kempski, and Oliver Hirsch, "Is a Mask That Covers the Mouth and Nose Free from Undesirable Side Effects in Everyday Use and Free of Potential Hazards?" *International Journal of Environmental Research and Public Health*, 4/21, 18(8): 4344)

Children Experience Difficulty Concentrating, Joylessness, Learning Difficulties, Fatigue, Stress, And Nightmares As A Result Of Mask Wearing, According To Researchers in Germany. "A recent observational study of tens of thousands of mask-wearing children in Germany helped the investigators objectify complaints of headaches (53%), difficulty concentrating (50%), joylessness (49%), learning difficulties (38%) and fatigue in 37% of the 25,930 children evaluated. Of the children observed, 25% had new onset anxiety and even nightmares. In children, the threat scenarios generated by the environment are further maintained via masks, in some cases, even further intensified, and in this way, existing stress is intensified (presence of subconscious fears). This can in turn lead to an increase in psychosomatic and stress-related illnesses." (Kai Kisielinski, Paul Giboni, Andreas Prescher, Bernd Klosterhalfen, David Graessel, Stefan Funken, Oliver Kempski, and Oliver Hirsch, "Is a Mask That Covers the Mouth and Nose Free from Undesirable Side Effects in Everyday Use and Free of Potential Hazards?" *International Journal of Environmental Research and Public Health*, 4/21, 18(8): 4344)

- **In The Study, Mask-Wearing Children Showed High Stress Levels, With 60% At The Highest Possible Level.** "For example, according to an evaluation, 60% of mask wearers showed stress levels of the highest grade 10 on a scale of 1 to a maximum of 10. Less than 10% of the mask wearers surveyed had a stress level lower than 8 out of a possible 10." (Kai Kisielinski, Paul Giboni, Andreas Prescher, Bernd Klosterhalfen, David Graessel, Stefan Funken, Oliver Kempski, and Oliver Hirsch, "Is a Mask That Covers the

Mouth and Nose Free from Undesirable Side Effects in Everyday Use and Free of Potential Hazards?" *International Journal of Environmental Research and Public Health*, 4/21, 18(8): 4344)

- **Masks "Caused Fear In 46% Of Children" In One Scientific Study.** "Both masks and face shields caused fear in 46% of children (37 out of 80) in a scientific study. If children are given the choice of whether the doctor examining them should wear a mask they reject this in 49% of the cases. Along with their parents, the children prefer the practitioner to wear a face visor (statistically significant with $p < 0.0001$)." (Kai Kisielinski, Paul Giboni, Andreas Prescher, Bernd Klosterhalfen, David Graessel, Stefan Funken, Oliver Kempski, and Oliver Hirsch, "Is a Mask That Covers the Mouth and Nose Free from Undesirable Side Effects in Everyday Use and Free of Potential Hazards?" *International Journal of Environmental Research and Public Health*, 4/21, 18(8): 4344)

A Pediatric Immunologist Cites "Obvious Socio-Emotional And Educational Harms From Masking Children For This Unprecedented Duration Of Time." "The pediatric immunologist said, 'Even with a new variant, the onus is on those who recommend masking kids to robustly demonstrate a meaningful benefit, especially when the pre-Delta study of the Georgia schools did not find one, and when there are obvious socio-emotional and educational harms from masking children for this unprecedented duration of time.'" (David Zweig, "The Science of Masking Kids at School Remains Uncertain," *New York Magazine's Intelligencer*, 8/20/21)

Experts Find Children Can Face Developmental Setbacks From Wearing Masks

Masking's Impact On "Social Interaction Is Particularly Serious For Children." "The mask-related disturbance of verbal and non-verbal communication and, thus, of social interaction is particularly serious for children. Masks restrict social interaction and block positive perceptions (smiling and laughing) and emotional mimicry." (Kai Kisielinski, Paul Giboni, Andreas Prescher, Bernd Klosterhalfen, David Graessel, Stefan Funken, Oliver Kempski, and Oliver Hirsch, "Is a Mask That Covers the Mouth and Nose Free from Undesirable Side Effects in Everyday Use and Free of Potential Hazards?" *International Journal of Environmental Research and Public Health*, 4/21, 18(8): 4344)

Dr. Lloyd Fisher, President Of The Massachusetts Chapter Of The American Academy Of Pediatrics: "It Is Important For Children To See Facial Expressions Of Their Peers And The Adults Around Them In Order To Learn Social Cues And Understand How To Read Emotions." "'Mask-wearing among children is generally considered a low-risk mitigation strategy; however, the negatives are not zero, especially for young children,' said Lloyd Fisher, the president of the Massachusetts chapter of the American Academy of Pediatrics. 'It is important for children to see facial expressions of their peers and the adults around them in order to learn social cues and understand how to read emotions.' Some children with special needs, for example those with articulation delays, may be most affected, he suggested." (David Zweig, "The Science of Masking Kids at School Remains Uncertain," *New York Magazine's Intelligencer*, 8/20/21)

A Leader With The American Academy Of Pediatrics Said, "There Very Good Reasons" Not To Mask Children, Including For Their "Social Emotional Learning." "'There are very good reasons that the World Health Organization has repeatedly affirmed their guidance for children under 6 to not wear masks,' said a pediatrician who has both state and national leadership roles in the AAP but who wished to remain anonymous because they did not want to jeopardize their roles in the organization.

'Reading faces is critical for social emotional learning. And all children are actively learning language the first five years of life, for which seeing faces is foundational,' the pediatrician said." (David Zweig, "The Science of Masking Kids at School Remains Uncertain," New York Magazine's Intelligencer, 8/20/21)

Experts Find Children Can Face Medical Complications From Wearing Masks

Mask-Wearing Children Can Face "Increased Carbon Dioxide Levels In The Blood," Exposure To Pathogens, Skin Problems, And Distractions From Learning. "Those who have myopia can have difficulty seeing because the mask fogs their glasses. (This has long been a problem for medical students in the operating room.) Masks can cause severe acne and other skin problems. The discomfort of a mask distracts some children from learning. By increasing airway resistance during exhalation, masks can lead to increased levels of carbon dioxide in the blood. And masks can be vectors for pathogens if they become moist or are used for too long." (Marty Makary and H. Cody Meissner, "The Case Against Masks for Children," The Wall Street Journal, 8/8/21)

Children Wearing Masks "Can Develop A Mouth Deformity And Elongated Face." "Some children compensate for such difficulties by breathing through their mouths. Chronic and prolonged mouth breathing can alter facial development. It is well-documented that children who mouth-breathe because adenoids block their nasal airways can develop a mouth deformity and elongated face." (Marty Makary and H. Cody Meissner, "The Case Against Masks for Children," The Wall Street Journal, 8/8/21)

THE CDC IGNORES THE LACK OF EVIDENCE ON MASK MANDATES FOR STUDENTS, BUT OTHER COUNTRIES DON'T

Many European Nations "Have Exempted Kids…From Wearing Masks In Classrooms" With "No Evidence Of More Outbreaks In Schools In Those Countries Relative To Schools In The U.S." "In the realm of science and public-health policy outside the U.S., the implications of these particular findings are not exactly controversial. Many of America's peer nations around the world — including the U.K., Ireland, all of Scandinavia, France, the Netherlands, Switzerland, and Italy — have exempted kids, with varying age cutoffs, from wearing masks in classrooms. Conspicuously, there's no evidence of more outbreaks in schools in those countries relative to schools in the U.S., where the solid majority of kids wore masks for an entire academic year and will continue to do so for the foreseeable future." (David Zweig, "The Science of Masking Kids at School Remains Uncertain," New York Magazine's Intelligencer, 8/20/21)

In The United Kingdom, The Department For Education Advised In August 2021 That "Face Coverings Are No Longer Advised For Pupils." "Face coverings are no longer advised for pupils, staff and visitors either in classrooms or in communal areas." ("Schools COVID-19 operational guidance," U.K. Department for Education, 8/27/21)

- **The Department For Education Guidance Was Directed Toward School Leaders And Staff In Primary And Secondary Schools, Among Others.** "This guidance explains the actions school leaders should take to reduce the risk of transmission of coronavirus (COVID-19) in their school. This includes public

health advice, endorsed by Public Health England (PHE). It is for leaders and staff in: primary schools; secondary schools (including sixth forms); special schools, special post-16 providers and alternative provision; 16 to 19 academies; infant, junior, middle, upper schools; [and] boarding schools. We expect independent schools to follow the control measures set out in this guidance in the same way as state-funded schools, and health and safety legislation applies equally to independent schools." ("Schools COVID-19 operational guidance," U.K. Department for Education, 8/27/21)

Norwegian Public Health Officials "Do Not Recommend The Use Of Face Masks By Children." "We do not recommend the use of face masks by children. Children may have difficulty wearing a face mask correctly, and very young children may find it difficult to breathe well when wearing a face mask." ("Use of face masks in schools and childcare centres," Norwegian Institute of Public Health, 8/14/20)

- **Further, Norwegian Public Health Officials "Do Not Recommend The Use Of Face Masks In Schools."** "We do not recommend the use of face masks in schools. This applies to both students and staff in primary school, secondary school and upper secondary school. The same applies to children and staff in childcare centres." ("Use of face masks in schools and childcare centres," Norwegian Institute of Public Health, 8/14/20)

- **Norwegian Institute Of Public Health: "Transmission In Schools And Childcare Centres Contributes Only To A Small Extent In The Spread Of COVID-19 In The Society."** ("Advice and information for children and adolescents," Norwegian Institute of Public Health, 8/19/21)

In Sweden, "Classes Have Been Compulsory For All Pupils Up To The Age Of 16, With No Mandatory Face Masks For Pupils Or Teachers." "The country's public health authorities made the decision to keep schools open at the start of the outbreak and they stuck by this even when the death rate was ten times higher than in Sweden's Nordic neighbours. Classes have been compulsory for all pupils up to the age of 16, with no mandatory face masks for pupils or teachers." ("Sweden has kept schools open during the pandemic despite spike in cases," France 24, 9/17/20)

- **Sweden, Which Has No Mask Mandates In Schools For Students Under 16 Years Old, Had "Zero COVID Deaths Among Its 1.8M Children During First Wave."** "With open schools and no masks for ages 1-15 in Sweden, there were zero COVID deaths among its 1.8M children during first wave. Teachers had lower risk than average of other professions. So, we knew early on that schools are safe without masks." (Jonas F. Ludvigsson, M.D., Ph.D., Lars Engerström, M.D., Ph.D., Charlotta Nordenhäll, M.D., Ph.D., and Emma Larsson, M.D., Ph.D., "Open Schools, Covid-19, and Child and Teacher Morbidity in Sweden," *The New England Journal of Medicine*, 1/6/21, 384:669-671)

Ireland does not require masks in schools. "In March, Ireland's Department of Health announced that it won't require masks in schools because they 'may exacerbate anxiety or breathing difficulties for some students.'" (Marty Makary and H. Cody Meissner, "The Case Against Masks for Children," *The Wall Street Journal*, 8/8/21)

The World Health Organization "Differs Substantially" From The CDC By Not Recommending Universal Masking For Kids Under 12 Years Of Age

The World Health Organization Advises That "Children Aged 5 Years And Under Should Not Be Required To Wear Masks." "In general, children aged 5 years and under should not be required to wear masks. This advice is based on the safety and overall interest of the child and the capacity to appropriately use a mask with minimal assistance." (World Health Organization, "Coronavirus disease (COVID-19): Children and masks," World Health Organization website, 8/21/20)

- **The World Health Organization And UNICEF Recommend Masks For Children Aged 6-11 Only Under Certain Circumstances.** "WHO and UNICEF advise that the decision to use masks for children aged 6-11 should be based on the following factors: Whether there is widespread transmission in the area where the child resides[;] The ability of the child to safely and appropriately use a mask[;] Access to masks, as well as laundering and replacement of masks in certain settings (such as schools and childcare services)[;] Adequate adult supervision and instructions to the child on how to put on, take off and safely wear masks[;] Potential impact of wearing a mask on learning and psychosocial development, in consultation with teachers, parents/caregivers and/or medical providers[;] Specific settings and interactions the child has with other people who are at high risk of developing serious illness, such as the elderly and those with other underlying health conditions." (World Health Organization, "Coronavirus disease (COVID-19): Children and masks," World Health Organization website, 8/21/20)

The World Health Organization's Guidance On Masking Children "Differs Substantially From The CDC's Recommendations." "These countries, along with the World Health Organization, whose child-masking guidance differs substantially from the CDC's recommendations, have explicitly recognized that the decision to mask students carries with it potential academic and social harms for children and may lack a clear benefit. To date, the highly transmissible Delta variant has not led them to change this calculus. (Many experts I spoke with told me that while the Delta variant represents a major and concerning new development in the Covid pandemic, it probably shouldn't change our thinking on a mask requirement for schools.)" (David Zweig, "The Science of Masking Kids at School Remains Uncertain," *New York Magazine's Intelligencer*, 8/20/21)

EXPERTS' SUGGESTIONS TO POLICYMAKERS: CONSULT PARENTS, CONSIDER IMPACT OF MASKS ON KIDS, MAKE INFORMED DECISIONS BASED ON RELIABLE DATA AND RESEARCH

The World Health Organization And UNICEF Encourage Policymakers To Consider The "Potential Impact Of Wearing A Mask On Learning And Psychosocial Development, In Consultation With Teachers, Parents/Caregivers And/Or Medical Providers." "WHO and UNICEF advise that the decision to use masks for children aged 6-11 should be based on the following factors: Whether there is widespread transmission in the area where the child resides[;] The ability of the child to safely and appropriately use a mask[;] Access to masks, as well as laundering and

replacement of masks in certain settings (such as schools and childcare services)[;] Adequate adult supervision and instructions to the child on how to put on, take off and safely wear masks[;] Potential impact of wearing a mask on learning and psychosocial development, in consultation with teachers, parents/caregivers and/or medical providers[;] Specific settings and interactions the child has with other people who are at high risk of developing serious illness, such as the elderly and those with other underlying health conditions." (World Health Organization, "Coronavirus disease (COVID-19): Children and masks," World Health Organization website, 8/21/20)

- **Researchers in Germany Assert Policymakers Should Take Into Account "The Proven Mask-Induced Mild To Moderate Cognitive Impairment With Impaired Thinking, Decreased Attention And Dizziness, As Well As The Psychological And Neurological Effects" When Considering Mandating Masks For Students.** "The proven mask-induced mild to moderate cognitive impairment with impaired thinking, decreased attention and dizziness, as well as the psychological and neurological effects, should be additionally taken into account when masks are compulsory at school and in the vicinity of both public and non-public transport, also regarding the possibility of an increased risk of accidents (see also occupational health side effects and hazards)." (Kai Kisielinski, Paul Giboni, Andreas Prescher, Bernd Klosterhalfen, David Graessel, Stefan Funken, Oliver Kempski, and Oliver Hirsch, "Is a Mask That Covers the Mouth and Nose Free from Undesirable Side Effects in Everyday Use and Free of Potential Hazards?" *International Journal of Environmental Research and Public Health*, 4/21, 18(8): 4344)

Dr. Marty Makary and Dr. H. Cody Meissner: "Let's See Data Showing The Benefits [Of Masking Students] And Weigh Them Against The Long-Term Harm" Before Mandating Students Wear Masks. "Before we order the masking of 56 million Americans who are too young to vote and don't have a lobby, let's see data showing the benefits and weigh them against the long-term harm." (Marty Makary and H. Cody Meissner, "The Case Against Masks for Children," *The Wall Street Journal*, 8/8/21)

Doctor: A Student Wearing A Mask In School "Should Be An Individual, Nuanced Decision"

Dr. Lucy M. McBride, M.D. And Practicing Internist: "I'm Against Mask Mandates For Kids Bc There Is No One-Size-Fits-All Prescription." "To be clear: I'm against mask mandates for kids bc there is no one-size-fits-all prescription. Kids who are high-risk or who live w/ high-risk, non-immune family may decide, for ex, to mask in school when/if COVID prevalence is high. This should be an individual, nuanced decision" (Lucy McBride, MD, Twitter, 7/9/21)

EXPERTS: DELTA VARIANT SHOULDN'T OPEN THE DOOR TO MASK REQUIREMENTS FOR STUDENTS IN SCHOOLS

"A Common Argument Right Now Is That The Emergence Of The Delta Variant Changes Everything." "A common argument right now is that the emergence of the Delta variant changes everything. Currently, some regions of the U.S. are seeing a surge of infections and hospitalizations among young people. But the numbers coming out of Britain continue to suggest that Delta is not more virulent — that is, it does not

cause more severe illness on an individual basis to unvaccinated people — despite being more contagious. A pediatric immunologist at a major university hospital who was not authorized to speak publicly said, 'It is not biologically plausible that the same variant somehow is more dangerous for kids in the U.S. than it is in the U.K.'" (David Zweig, "The Science of Masking Kids at School Remains Uncertain," *New York Magazine's Intelligencer*, 8/20/21)

But Experts Indicate The Delta Variant, While A "Major And Concerning" Development, "Probably Shouldn't Change Our Thinking On A Mask Requirement For Schools." "These countries, along with the World Health Organization, whose child-masking guidance differs substantially from the CDC's recommendations, have explicitly recognized that the decision to mask students carries with it potential academic and social harms for children and may lack a clear benefit. To date, the highly transmissible Delta variant has not led them to change this calculus. (Many experts I spoke with told me that while the Delta variant represents a major and concerning new development in the Covid pandemic, it probably shouldn't change our thinking on a mask requirement for schools.)" (David Zweig, "The Science of Masking Kids at School Remains Uncertain," *New York Magazine's Intelligencer*, 8/20/21)

- **Dr. Elissa Schechter-Perkins: "I Don't Think That Delta Changes The Calculus."** "More broadly, Schecter-Perkins said, 'I don't think that Delta changes the calculus because it still seems clear that it doesn't cause more severe disease, so it still doesn't change the fundamental question of 'What are we trying to achieve by masking kids when they are still extremely unlikely to suffer from severe illness or death if infected?''" (David Zweig, "The Science of Masking Kids at School Remains Uncertain," *New York Magazine's Intelligencer*, 8/20/21)

This research report was prepared by the Office of the Governor of Montana for informational purposes.

Exhibit T

Juvenile Code: Dependency

ORS 419B.005 Definitions

As used in ORS 419B.005 (Definitions) to 419B.050 (Authority of health care provider to disclose information), unless the context requires otherwise:

(1) (a) "Abuse" means:

(A) Any assault, as defined in ORS chapter 163, of a child and any physical injury to a child which has been caused by other than accidental means, including any injury which appears to be at variance with the explanation given of the injury.

(B) Any mental injury to a child, which shall include only observable and substantial impairment of the child's mental or psychological ability to function caused by cruelty to the child, with due regard to the culture of the child.

(C) Rape of a child, which includes but is not limited to rape, sodomy, unlawful sexual penetration and incest, as those acts are described in ORS chapter 163.

(D) Sexual abuse, as described in ORS chapter 163.

(E) Sexual exploitation, including but not limited to:

(i) Contributing to the sexual delinquency of a minor, as defined in ORS chapter 163, and any other conduct which allows, employs, authorizes, permits, induces or encourages a child to engage in the performing for people to observe or the photographing, filming, tape recording or other exhibition which, in whole or in part, depicts sexual conduct or contact, as defined in ORS 167.002 (Definitions for ORS 167.002 to 167.027) or described in ORS 163.665 (Definitions) and 163.670 (Using child in display of sexually explicit conduct), sexual abuse involving a child or rape of a child, but not including any conduct which is part of any investigation conducted pursuant to ORS 419B.020 (Duty of department or law enforcement agency receiving report) or which is designed to serve educational or other legitimate purposes; and

(ii) Allowing, permitting, encouraging or hiring a child to engage in prostitution as described in ORS 167.007 (Prostitution) or a commercial sex act as defined in ORS 163.266 (Trafficking in persons), to purchase sex with a minor as described in ORS 163.413 (Purchasing sex with a minor) or to engage in commercial sexual solicitation as described in ORS 167.008 (Commercial sexual solicitation).

(F) Negligent treatment or maltreatment of a child, including but not limited to the failure to provide adequate food, clothing, shelter or medical care that is likely to endanger the health or welfare of the child.

(G) Threatened harm to a child, which means subjecting a child to a substantial risk of harm to the child's health or welfare.

Exhibit T

Exhibit U

School Attendance

ORS 339.288
Prohibitions on use of certain restraints

(1) The use of the following types of restraint on a student in a public education program is prohibited:

(a) Chemical restraint.

(b) Mechanical restraint.

(c) Prone restraint.

(d) Supine restraint.

(e) Any restraint that involves the intentional and nonincidental use of a solid object, including a wall or the floor, to impede a student's movement, unless the restraint is necessary to prevent an imminent life-threatening injury or to gain control of a weapon.

(f) Any restraint that places, or creates a risk of placing, pressure on a student's neck or throat.

(g) Any restraint that places, or creates a risk of placing, pressure on a student's mouth, unless the restraint is necessary for the purpose of extracting a body part from a bite.

(h) Any restraint that impedes, or creates a risk of impeding, breathing.

(i) Any restraint that involves the intentional placement of the hands, feet, elbow, knee or any object on a student's neck, throat, genitals or other intimate parts.

(j) Any restraint that causes pressure to be placed, or creates a risk of causing pressure to be placed, on the stomach or back by a knee, foot or elbow bone.

(k) Any action designed for the primary purpose of inflicting pain.

(2) As used in this section:

(a) "Chemical restraint" means a drug or medication that is used on a student to control behavior or restrict freedom of movement and that is not:

(A) Prescribed by a licensed physician or other qualified health professional acting under the professional's scope of practice for standard treatment of the student's medical or psychiatric condition; and

(B) Administered as prescribed by a licensed physician or other qualified health professional acting under the professional's scope of practice.

(b) (A) "Mechanical restraint" means a device used to restrict the movement of a student or the movement or normal function of a portion of the body of a student.

Exhibit U

Exhibit W

NWC
School District 21

American Rescue Plan Elementary and Secondary School Emergency Relief Fund (ARP ESSER); OAR 581-022-0106 (State Operational Plan)

Safe Return to In-Person Instruction and Continuity of Services

Exhibit W

District Information

Institution ID: 4131 **Institution Name:** North Wasco County School District 21

District Continuity of Services Plan/RSSL

Contact Name and Title: Dr. Carolyn Bernal, Superintendent

Contact Phone: 541-506-3420 **Contact Email:** bernalc@nwasco.k12.or.us______________________

Safe Return to In-Person Instruction and Continuity of Services Plan

In order to best support students and families with the safest possible return to school for the 2021 school year, the Oregon Department of Education (ODE) has created an operational plan template to align guidance from the federal and state level in support of local decision-making and transparency of health and safety measures in the communities that school districts serve. The Safe Return to In-Person Instruction and Continuity of Services Plan serves the following purposes:

1) Replaces the Ready Schools, Safe Learners Operational Blueprint required under Executive Order 21-06; and
2) Meets the requirements for:
   a. An operational plan required under OAR 581-022-0106(4), while aligning the CDC Guidance on School Reopening with the Ready Schools, Safe Learners Resiliency Framework for the 2021-22 School Year (RSSL Resiliency Framework);
   b. Section 2001(i)(1) of the ARP ESSER and the US Department of Education's Interim Final Requirements for Safe Return/Continuity of Services Plan; and
   c. Communicable Disease Plan and Isolation Plan under OAR 581-022-2220 (Division 22 requirements).

As districts plan and implement the recommendations in ODE's RSSL Resiliency Framework, they will need to consider a continuum of risk levels when all recommendations cannot be fully implemented. For example, universal correct wearing of face coverings between people is one of the most effective preventive measures. However, there will be times when this is not possible based on a specific interaction or a physical space limitation, such as during meal times. It will be necessary to consider and balance the mitigation strategies described to best protect health and safety while ensuring full time in person learning.

ODE remains committed to the guiding principles introduced in spring of 2020 to generate collective action and leadership for efforts to respond to COVID-19 across Oregon. These principles are updated to reflect the current context:

- **Ensure safety and wellness**. Prioritizing basic needs such as food, shelter, wellness, supportive relationships and support for mental, social, and emotional health of students and staff.
- **Center health and well-being**. Acknowledging the health and mental health impacts of this past year, commit to creating learning opportunities that foster creative expression, make space for reflection and connection, and center on the needs of the whole child rather than solely emphasizing academic achievement.

- **Cultivate connection and relationship**. Reconnecting with one another after a year of separation can occur through quality learning experiences and deep interpersonal relationships among families, students and staff.
- **Prioritize equity**. Recognize the disproportionate impact of COVID-19 on Black, American Indian/Alaska Native, and Latino/a/x, Pacific Islander communities; students experiencing disabilities; students living in rural areas; and students and families navigating poverty and houselessness. Apply an equity-informed, anti-racist, and anti-oppressive lens to promote culturally sustaining and revitalizing educational systems that support every child.
- **Innovate**. Returning to school is an opportunity to improve teaching and learning by iterating on new instructional strategies, rethinking learning environments, and investing in creative approaches to address unfinished learning.

Planning Mental Health Supports

ARP ESSER & OAR 581-022-0106 Component	Extent to which district has adopted policies and description of policies adopted to ensure continuity of services	How do adopted policies reflect RSSL guiding principles?
Devote time for students and staff to connect and build relationships	Each school site has developed an individual plan that describes how time will be devoted to connect and build relationships both for students and staff. Those plans can be reviewed at the following links: Chenowith ES Health and Well-Being Plan Colonel Wright ES Health and Well Being Plan Dry Hollow ES Health and Well Being Plan TDMS Health and Well-Being Plan TDHS Health and Well-Being Plan	This follows our district equity guiding principles and policy centering on the health and well being of students and committing to make space for students to connect and focus on their well being as well as reconnecting with our families and students after a year of separation from a typical school year. Our adopted policies, actions, and school site plans as noted (school site health and well-being plans align with ODE Care and Connection Week) will allow for relationship building. This aligns with the RSSL guiding principles around centering on the health and wellbeing of students and staff.
Ample class time, and private time if needed, for creative opportunities that allow students and staff to explore and process their experiences	Each school site has developed an individual plan that describes how time will be created for staff and students to creatively explore and process their experiences. Those plans can be reviewed at the following links: Chenowith ES Health and Well-Being Plan Colonel Wright ES Health and Well Being Plan Dry Hollow ES Health and Well Being Plan TDMS Health and Well-Being Plan TDHS Health and Well-Being Plan	This follows our district equity guiding principles and policy centering on the health and well being of our students by building in time to make space for reflection & processing and to support students with additional staffing that is committed to the whole child as opposed to just academic needs. Our adopted policies, actions, and school site plans as noted (school site health and well-being plans align with ODE Care and Connection Week) will allow for relationship building. This aligns with the RSSL guiding principles around centering on the health and wellbeing of students and staff.

ARP ESSER & OAR 581-022-0106 Component	Extent to which district has adopted policies and description of policies adopted to ensure continuity of services	How do adopted policies reflect RSSL guiding principles?
Link staff, students and families with culturally relevant health and mental health services and supports	Staff will be reminded of mental health support available through the Employee Assistance Program, and how to access this support. As needed, our staff will share mental health resources and support available within our community with families, while being sensitive to cultural uniqueness.	Our district equity policy and instructional frameworks focus on Health and Wellness. This reflects our guided principles in regards to culturally relevant support and pedagogy. Our guiding principles center on the health and well being of students, with particular attention and focus on the mental/social/emotional well being of our marginalized and underrepresented students. We are committed to making space and providing opportunities for students to connect and focus, as well as reconnect with their families and students after a year of separation from a typical school year. This is evident in our commitment to establishing sub-committee groups that meet regularly and include the District Community Outreach Team, the District Wellness Committee and the District Equity Committee. Local Wellness Policy Educational Equity
Foster peer/student lead initiatives on wellbeing and mental health	NWCSD student leadership teams, clubs and activities in each building lead building level student initiatives to support student mental health and wellbeing.	Our district equity policy and instructional frameworks focus on Health and Wellness. This reflects our guided principles in regards to culturally relevant support and pedagogy. Our guiding principles center on the health and well being of students, with particular attention and focus on the mental/social/emotional well being of our marginalized and underrepresented students. We are committed to creating space such as mentorships, internships and partnerships while providing opportunities for students to connect. This is evident in our commitment to establishing sub-committee groups that meet regularly and include the District Community Outreach Team, the District Wellness Committee

		and the District Equity Committee. Local Wellness Policy Educational Equity

Communicable Disease Management Plan

Please provide a link to the district's **communicable disease management plan** that describes measures put in place to limit the spread of COVID-19 within school settings. (OAR 581-022-2220). The advised components of the plan and additional information are found on pages 20 and 21 of the RSSL Resiliency Framework and meet the ESSER process requirements of "coordination with local public health authorities."

Link: NWCSD Communicable Disease Plan *(Currently Under revision for updates for the 2021/2022 school year)*

ARP ESSER Component	Extent to which district has adopted policies and description of policies adopted to ensure continuity of services	How do adopted policies reflect RSSL guiding principles?
Coordination with local public health authority(ies) including Tribal health departments	The North Wasco County School District collaborates on a weekly basis with the North Central Public Health District following their guidance regarding quarantine and isolation. The District consults with the NCPHD regarding COVID-19 exposures and positive cases as well as other mitigation measures that help minimize the spread of COVID-19. The North Wasco County School District will continue to collaborate with the Confederated Tribes of Umatilla Indian Reservation to ensure consistent communication and collaboration with the Tribal health departments.	This follows our equity district guiding principles and policy centering on the health and safety of students by ensuring all the necessary safety protocols and mitigation measures are being followed. The District Communicates with our Local Public Health Authority (LPHA) on all suspected cases or exposures and completes necessary line list information for the County on all positive cases and close contacts identified. In addition, as an ongoing effort, we continue to work in partnership with our families by making personal phone calls to survey their readiness and feedback on the return to school. This aligns with the RSSL guiding principles around centering on the health and safety of students.

Isolation Plan

Please provide a link to the district's plan to **maintain health care and space** that is appropriately supervised and adequately equipped for providing first aid, and **isolates** the sick or injured child. (OAR 581-022-2220). If planning for this space is in your communicable disease management plan for COVID-19, please provide the page number.

Each school will have a separate space identified for isolation. This is so that students with Covid-19 like symptoms or other communicable diseases will be separated from students using the health room for non- communicable health care.

NWCSD uses Planning and Responding to COVID-19 Scenarios in Schools with exposures and positive cases.

Additional Isolation Room Resources:

Link: NWCSD Communicable Disease Plan *(Currently Under revision for updates for the 2021/2022 school year)*

Mitigation Strategies

School administrators are required to **exclude staff or students from school** whom they have reason to suspect have been exposed to COVID-19. (OAR 333-019-0010; OAR 333-019-0010)

Please complete the table below to include the extent to which the district has adopted policies and the description of each policy for each mitigation strategy. In developing the response, please review and consider the CDC guidance and the RSSL Resiliency Framework for each mitigation strategy. Additional documents to support district and school planning are available on the ODE Ready Schools, Safe Learners website.

Advised mitigation strategy	Extent to which district has adopted policies and description of policies adopted	How do adopted policies reflect RSSL guiding principles?
COVID-19 vaccinations to educators, other staff, and students if eligible	All NWCSD employees have had an opportunity to be vaccinated. All NWCSD eligible students have had an opportunity to be vaccinated. Currently 53% of Wasco County residents are fully vaccinated. NWCSD will continue to collaborate with our LPHA to assist families in the 2021/22 school year and will encourage vaccination where appropriate for students. NWCSD will implement the new staff vaccination mandate and provide employee on site vaccination clinics to assist employees with getting their vaccines.	This follows our district equity guiding principles and policy and centers on the health and safety of staff and students by encouraging vaccination; assisting our families with accessing vaccination; collaborating with partner agencies to provide vaccination clinics. This aligns with the RSSL guiding principles around centering on the health and safety of staff and students.

Advised mitigation strategy	Extent to which district has adopted policies and description of policies adopted	How do adopted policies reflect RSSL guiding principles?
Universal and correct wearing of face coverings	**School Buses:** **Masks required** for all persons over the age of 2, regardless of vaccination status. This is a CDC order that remains in effect until lifted by the federal government and cannot be waived by state or local authorities. **In School Buildings/District Properties:** **Masks required** indoors for all persons, regardless of vaccination status. Students may remove their mask while actively eating or drinking; staff may remove their mask while actively eating or drinking outside of the presence of students, and if working independently at their desk or behind a closed door. **For after school sports and activities:** **Outdoors:** **Masks are required outdoors** for spectators (5 years or older), regardless of vaccination status, attending a school event, an outdoor practice and/or competition when 6' of physical distance cannot be maintained. **Masks are required indoors** for all persons (unless participating in an activity for which mask guidance has been modified for safety considerations such as swimming, wrestling, etc.,)	This follows our district equity guiding principles and policy centering on the health and safety of staff and students by staff training on updated face covering/mask guidance and providing information on appropriate types of masks NWCSD Face Covering Guidance. **Additional PPE:** Staff who are performing tasks that require additional PPE per guidance from OHA will be provided them. Additional PPE may include medical grade masks (as defined by ODE as "disposable surgical/procedural face mask or respirator (N95/KN95)", gowns, face shields, gloves, plastic partitions or barriers. This aligns with the RSSL guiding principles around centering on the health and safety of staff and students.

Physical distancing and cohorting	**Physical Distancing:** Classroom configuration will return to standard pre-COVID classroom setup with emphasis of maintaining at least 3 ft physical distancing between student desks to the extent possible. Staff and students will maintain as much distance as possible which helps mitigate transmission of COVID-19 Minimize having students stand in Bathroom & lunch lines as much as possible. Continue with physical distancing markers and directional signage in place from SY20-21. Add more wall signage as needed. **Cohorting:** **Elementary School Setting:** Students will be consistently in the same cohort per class unless exiting for specialized groups. However, these groups will also maintain clear contact logs daily. Individual cohorts will remain together at lunch. Each grade level will be at recess at the same time.(Grades K, 1, 2, 3, 4, 5 will be separate at each recess time.) **Middle School Setting:** Students will rotate through their class schedule by assigned cohort. **High School Setting:** Where cohorting is not possible, and in alignment with CDC recommendations, implementing the use of consistent face covering and 3 feet distancing is an equally effective	In conjunction with our district policies (including equity) and in partnership with OHA and ODE, we *strongly advise* that schools support and promote physical distancing as described below: • Support physical distancing in all daily activities and instruction, maintaining at least 3 feet between students to the extent possible. • Consider physical distancing requirements when setting up learning and other spaces, arranging spaces and groups to allow and encourage at least 3 feet of physical distance. • Minimize time standing in lines and take steps to ensure that required distance between students is maintained, including marking spacing on floor, one-way traffic flow in constrained spaces, etc." (RSSL-RF, June 25, 2021). This aligns with the RSSL guiding principles around centering on the health and safety of staff and students.

	mitigation strategy where consistent cohorting cannot be achieved.	

Advised mitigation strategy	Extent to which district has adopted policies and description of policies adopted	How do adopted policies reflect RSSL guiding principles?
Ventilation and air flow	Schools with HVAC systems shall evaluate the system to minimize indoor air recirculation (thus maximizing fresh outdoor air) to the extent possible. Schools that do not have mechanical ventilation systems shall, to the extent possible, increase natural ventilation by opening windows and interior doors before students arrive and after students leave, and while students are present. Schools with HVAC systems shall ensure all filters are maintained and replaced as necessary to ensure proper functioning of the system. All intake ports that provide outside air to the HVAC system shall be cleaned, maintained, and cleared of any debris that may affect the function and performance of the ventilation system. Window and/or box fans positioned in open windows to blow fresh outdoor air into the classroom via one window, and indoor air out of the classroom via another window shall be utilized. Increased ventilation in areas where students with special health care needs receive medication or treatments shall be considered.	In conjunction with our district policies (including equity) and in partnership with ODE and OHA, we strongly advise that schools ensure effective ventilation and improve the indoor air quality in schools by: • Increasing the amount of fresh outside air that is introduced into the system; • Exhausting air from indoors to the outdoors; and • Cleaning the air that is recirculated indoors with effective filtration methods (e.g., HEPA filters) to remove virus-containing particles from the air" (RSSL-RF, June 25, 2021) Our district policies ensure that this is implemented district wide with a careful look at our older schools with classrooms and/or spaces that may need assistance with air ventilation. In those instances, air purifiers are being provided to ensure clean air distribution and ensure all our students and staff are safe. This is aligned with the guidance in the RSSL.

Handwashing and respiratory etiquette	Staff and students will be trained on the importance of hand and respiratory hygiene. Students and staff are encouraged to hand wash: Before entering a building or classroom. Before eating and after eating. After recess. After toileting. After touching nose or mouth. Hand sanitizer will be available for use upon entering District buildings.	In conjunction with our district equity policy and in partnership with OHA and ODE, we strongly advise that schools create protocols and systems to ensure access to soap, water and alcohol-based hand sanitizer with at least 60% alcohol. Schools will prioritize handwashing with soap and water after students or staff use the restroom" (RSSL-RF, June 25, 2021). Signs are provided in multiple languages in bathrooms and common areas to ensure communication is achieved. Visuals are also available as well as lessons in common opening times in our elementary schools. This aligns to equity by ensuring communication is accessible to all. This is aligned with the guidance in the RSSL.

Advised mitigation strategy	Extent to which district has adopted policies and description of policies adopted	How do adopted policies reflect RSSL guiding principles?
Free, on-site COVID-19 diagnostic testing	We do not plan on implementing this component broadly across all buildings. We will have a small supply of tests available through our LPHA. However, we primarily want people who are symptomatic to stay home. Our county has testing widely available and free to all our students and their families. We have information about testing widely available to our students and families and advise them to consult with a healthcare professional should they experience symptoms of COVID-19.	We continue to partner with our LPHA to determine if there are barriers to access testing in our community that schools can help reduce and/or eliminate.
COVID-19 screening testing	We do not plan on implementing this component broadly across all buildings. We will have a small supply of tests available through our LPHA. However, we primarily want people who are symptomatic to stay home. Our county has testing widely available and free to all our students and their families. We have information about testing widely available to our students and families and advise them to consult with a healthcare professional should they experience symptoms of COVID-19.	We continue to partner with our LPHA to determine if there are barriers to access testing in our community that schools can help reduce and/or eliminate.

Advised mitigation strategy	Extent to which district has adopted policies and description of policies adopted	How do adopted policies reflect RSSL guiding principles?
Public health communication	Staff will receive an updated COVID-19 training outlining the updated safety measures and mitigation strategies to prevent the spread of COVID-19. NWCSD utilizes the Planning and Responding to COVID-19 Scenarios in Schools and has staff trained to know what to do when a staff or student has a positive diagnosis or has been exposed to COVID-19. When a positive case is identified the Human Resources Director will work with the LPHA to determine the extent to which students and staff must be isolated from schools. Parents will also be sent home the "Too Sick for School" flyer and reminders to do a daily health check for symptoms with their children.	In conjunction with our district equity policy and in partnership with OHA and ODE, we strongly advise centering on the health and safety of staff and students by providing parents, students and families information on signs and symptoms of COVID-19 and what to do if they get sick. Through the lens of equity and noted in our policy, we ensure that language and communication style is not a barrier for our families. We provide translation services, interpreters and provide information to our families that reflect the community we serve. This follows the RSSL guiding principles around centering on the health and safety of staff and students.
Isolation and quarantine	Care Spaces have been set up in each building to isolate students showing symptoms of COVID-19 while at school. At each school, screening tools have been developed and staff at each building have been trained on the process for donning PPE, appropriate disposal of PPE, and interviewing students about symptoms and onset. Additionally, nursing staff of the district have a reporting protocol and will respond to buildings to assist with communications with students and parents.	This follows the RSSL guiding principles around centering on the health and safety of staff and students by identifying a space in each school where students exhibiting symptoms of COVID-19 or other communicable diseases can be isolated until they can be picked up. NWCSD also follows the document Planning and Responding to COVID-19 Scenarios in Schools when identifying close contacts needing to quarantine. This follows the RSSL guiding principles around centering on the health and safety of staff and students.

Accommodations for Children with Disabilities

Please describe the extent to which the district has adopted policies related to appropriate accommodation for children with disabilities with respect to health and safety protocols. Please describe any such policies.

Students are entitled to needed accommodations through documented 504 Plans and Individualized Education Plans (IEP). When students cannot follow the health and safety protocols due to a disability or health condition. NWCSD teams obtain a doctor's note, hold manifestation meetings as necessary, and make appropriate changes to the accommodations on the 504 Plan and/or IEP.

Policies: JBAA, IGBAJ-AR

Updates to this Plan

To remain in compliance with ARP ESSER requirements, school districts must regularly, but no less frequently than every six months (taking into consideration the timing of significant changes to CDC guidance on reopening schools), review, and as appropriate, revise its Safe Return to In-Person Instruction and Continuity of Services Plan.

Date Last Updated: August 26, 2021

to the academic, social, emotional, and mental health needs of all students and particularly those students disproportionately impacted by the COVID–19 pandemic. Given the unique circumstances in each State, we believe each SEA is best situated to determine what additional requirements to include in the LEA ARP ESSER plan. For example, an SEA might require that the LEA ARP ESSER plan include data that illustrates the LEA's most pressing needs or descriptions of promising practices that the LEA has implemented to accelerate learning. The SEA might also require that the LEA's ARP ESSER plan contain the information required in the LEA's plan for the safe return to in-person instruction and continuity of services, in which case the LEA may develop one plan that addresses both sets of requirements rather than two separate plans (*i.e.,* one plan that addresses use of ARP ESSER funds and the safe return to in-person instruction and continuity of services). The SEA also establishes the deadline by which the LEA must submit its ARP ESSER plan, which must be reasonable and should be within no later than 90 days after receiving its ARP ESSER allocation.

LEA ARP ESSER Plan Meaningful Consultation

COVID–19 has had a dramatic impact on the Nation's education system. In addition to disrupting teaching and learning, it has exacerbated existing inequities in our schools and school districts. Every aspect of student life has been impacted by the COVID–19 pandemic: Students' classes and courses of study have been interrupted and/or delayed and students' social, emotional, and mental health have been negatively impacted by the isolation and anxiety of living through a pandemic and quarantine along with the additional associated stresses placed on their families.[12]

As students and teachers continue to return to full-time in-person education, they will have important insights into how schools should approach prevention and mitigation of COVID–19, and into what may be needed to support student success. For this reason, in developing their ARP ESSER plans, LEAs will be required to meaningfully consult with students; families; school and district administrators (including special education administrators); and teachers, principals, school leaders, other educators, school staff, and their unions. Additionally, an LEA is also required to engage in meaningful consultation with each of the following, to the extent present in or served by the LEA: Tribes; civil rights organizations (including disability rights organizations); and stakeholders representing the interests of children with disabilities, English learners, children experiencing homelessness, children in foster care, migratory students, children who are incarcerated, and other underserved students. An LEA's decisions about how to use its ARP ESSER funds will directly impact the students, families, and stakeholders in their school district, and thus the LEA's plans must be tailored to the specific needs faced by students and schools within the district. These diverse stakeholders will have significant insight into what prevention and mitigation strategies should be pursued to keep students and staff safe, as well as how the various COVID–19 prevention and mitigation strategies impact teaching, learning, and day-to-day school experiences.

With regard to addressing the academic, social, emotional, and mental health needs of all students, particularly those most impacted by the pandemic, we believe that it is critical that LEAs solicit and consider the input of students and their families to identify their most pressing needs. Close coordination with Tribes is critical to effective support for Native American students, so LEAs need to consult Tribes, as applicable. In addition, the Department understands educators and students' families will have important insights into and observations of students' academic, social, emotional, and mental health needs garnered from their experiences during the COVID–19 pandemic. Stakeholders will similarly have critical insights into how best to address the academic impact of lost instructional time that LEAs are required to address with at least 20 percent of their ARP ESSER funds. For all of these reasons, through this consultation, LEAs will be better positioned to fully plan to use ARP ESSER funds to adequately respond to the needs of all students, particularly those most impacted by the COVID–19 pandemic.

LEA ARP ESSER Plan Accessibility

The requirement also mandates that LEA ARP ESSER plans be accessible, including to parents with limited English proficiency and individuals with a disability. This requirement is intended to help ensure that all parents, including parents with limited English proficiency or individuals with disabilities, are able to access and understand the information in an LEA's ARP ESSER plan, consistent with the Department's interpretation of Title VI of the Civil Rights Act of 1964 and existing obligations to parents with disabilities under the Americans with Disabilities Act (ADA).

LEA Plan for Safe Return to In-Person Instruction and Continuity of Services

Statute: Section 2001(i)(1) of the ARP Act requires each LEA that receives ARP ESSER funds to develop and make publicly available on the LEA's website, not later than 30 days after receiving ARP ESSER funds, a plan for the safe return to in-person instruction and continuity of services for all schools, including those that have already returned to in-person instruction. Section 2001(i)(2) of the ARP Act further requires that the LEA seek public comment on the plan and take those comments into account in the development of the plan. Finally, section 2001(i)(3) of the ARP Act states that an LEA that developed a plan for the safe return to in-person instruction and continuity of services prior to the date of enactment of the ARP Act will be deemed to have met the requirement to develop a plan under section 2001(i)(1) as long as the plan meets the statutory requirements (*i.e.,* is publicly available on the LEA's website and was developed after the LEA sought and took into account public comment).

Interim Final Requirement: As described in more detail below, this requirement clarifies what an LEA's plan for the safe return to in-person instruction and continuity of services must address and requires periodic review and, when needed, revision of the plan to ensure it remains relevant and meets statutory and regulatory requirements.

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[12] *See* Korman, H., O'Keefe, B., & Repka, M., (2020, Oct. 21). Missing in the Margins: Estimating the Scale of the Covid-19 Attendance Crisis. Bellweather Education Partners. Retrieved from: *https://bellwethereducation.org/publication/missing-margins-estimating-scale-covid-19-attendance-crisis#Why%20aren't%20students%20attending%20school?*; Sparks, S., (2020, Nov. 12) Children's Mental Health Emergencies Skyrocketed After COVID–19 Hit. What Schools Can Do, *Education Week.* Retrieved from: *https://www.edweek.org/leadership/childrens-mental-health-emergencies-skyrocketed-after-covid-19-hit-what-schools-can-do/2020/11*; Dorn, E., Hanckock, B., Sarakatsannis, J., & Viruleg, E. (2020). COVID–19 and Learning Loss—Disparities Grow and Students Need Help. *https://www.mckinsey.com/industries/public-and-social-sector/our-insights/covid-19-and-learning-loss-disparities-grow-and-students-need-help#*; Kuhfeld, M., Tarasawa, B., Johnson, A., Ruzek, E., & Lewis, K. (2020, Nov.). Learning During COVID–19: Initial Findings on Students' Reading and Math Achievement and Growth. NWEA. Retrieved from: *https://www.nwea.org/research/publication/learning-during-covid-19-initial-findings-on-students-reading-and-math-achievement-and-growth/*.

Exhibit X

First, the requirement clarifies that an LEA's plan must include how it will maintain the health and safety of students, educators, and other school and LEA staff, and the extent to which it has adopted policies, and a description of any such policies, on each of the CDC's safety recommendations including: Universal and correct wearing of masks; modifying facilities to allow for physical distancing (*e.g.,* use of cohorts/ podding); handwashing and respiratory etiquette; cleaning and maintaining healthy facilities, including improving ventilation; contact tracing in combination with isolation and quarantine, in collaboration with the State, local, territorial, or Tribal health departments; diagnostic and screening testing; efforts to provide vaccinations to school communities; appropriate accommodations for children with disabilities with respect to health and safety policies; and coordination with State and local health officials.

Second, the requirement further clarifies that the plan must describe how the LEA will ensure continuity of services, including but not limited to services to address students' academic needs and students' and staff social, emotional, mental health and other needs, which may include student health and food services.

Third, the requirement provides that, during the period of the ARP ESSER award established in section 2001(a) of the ARP Act (*i.e.,* until September 30, 2023),[13] an LEA must periodically, but no less frequently than every six months, review and, as appropriate, revise its plan. Consistent with section 2001(i)(2) of the ARP Act, which requires an LEA to seek public comment on the development of its plan, an LEA must seek public input and take such input into account in determining whether to revise its plan and, if it determines revisions are necessary, on the revisions it makes to its plan, *i.e.,* the LEA must seek public input on whether to revise its plan and on any revisions to its plan no less frequently than every six months (taking into consideration the timing of significant changes to CDC guidance on reopening schools). The requirement clarifies that, if the LEA revises its plan, the revised plan must address each of the aspects of safety currently recommended by the CDC or, if the CDC has updated its safety recommendations at the time the LEA is revising its plan, each of the updated safety recommendations. The requirement also clarifies that an LEA that developed a plan prior to enactment of the ARP Act that meets the requirements under section 2001(i)(1) and (2) of the ARP Act but does not address each of the required aspects of safety established in this requirement must, as part of the required periodic review, revise its plan consistent with these requirements no later than six months after it last reviewed its plan.

Fourth, under the requirement, the plans must be: In an understandable and uniform format; to the extent practicable, written in a language that parents can understand or, if not practicable, orally translated; and upon request by a parent who is an individual with a disability, provided in an alternative format accessible to that parent.

Reasons: The statutory requirements for each LEA to develop a plan for the safe return to in-person instruction and continuity of services, to seek and incorporate public comment on the plan, and to make the plan publicly available are important for planning and transparency as LEAs work to return to, or continue, the safe operation of in-person instruction. However, the statute does not explicitly define what it means for a plan to provide for a safe return to and continuity of in-person instruction.

Because safe return to and continuity of in-person instruction is fundamental to addressing the lost instructional time and disengagement that many students have experienced during the COVID–19 pandemic, it is essential that these plans contain precise information about how LEAs will focus on prevention and mitigation of COVID–19 specific to their communities, in order to keep students, staff, and families healthy and to avoid future shutdowns. To ensure that each plan contains a sufficient level of specificity, the requirement sets forth several aspects of safety that each LEA plan must address.[14] These elements are consistent with current, relevant guidance from the CDC related to the safe reopening of schools.[15] The requirement does not mandate that an LEA adopt the CDC guidance, but only requires that the LEA describe in its plan the extent to which it has adopted the key prevention and mitigation strategies identified in the guidance. The requirement also ensures that each plan will specifically address how it will continue to provide services that meet student and staff needs. Section 2001(i) of the ARP Act requires that the plan address "continuity of services," but does not specifically identify those services. The requirement clarifies that, in addition to meeting academic needs, the plan must also address how the LEA will continue to provide services to meet students' academic needs and students' and staff social, emotional, mental health, and other needs through, for example, continuing to provide students meals and access to medical services. According to the National School Lunch Program, before COVID–19, schools provided free or reduced-priced lunches to approximately 22 million students each day.[16] This is just one example of the many essential services that schools provide. For this reason, the requirement ensures that each LEA separately addresses continuity of services as a discrete prong of the plan.

The statute does not explicitly specify when or how often an LEA's plan must be reviewed and revised. To help an LEA adapt to the constantly evolving status of the COVID–19 pandemic, the requirement mandates that, during the period of the grant, an LEA review its plan at least every six months (taking into consideration the timing of significant changes to CDC guidance on reopening schools), and seek public input in determining whether, and what, revisions are necessary. The requirements also make clear that a revised plan must continue to address safety recommendations from the CDC, which must include updated CDC guidance, to ensure that the plans continue to provide useful information that addresses the most up-to-date research on COVID–19 prevention and mitigation. This requirement will also ensure that an LEA that developed a safe return to in-person instruction and continuity of services plan prior to enactment of the ARP Act and the requirement will, at least within six months of receipt of its grant, revise, as

[13] ARP ESSER funds are subject to the Tydings amendment in section 421(b) of the General Education Provisions Act, 20 U.S.C. 1225(b), and are therefore available to SEAs and LEAs for obligation through September 30, 2024. Review and revisions, if necessary, are not required during the Tydings period.

[14] As described above, each plan must address: Universal and correct wearing of masks; modifying facilities to allow for physical distancing (*e.g.,* use of cohorts/podding); handwashing and respiratory etiquette; cleaning and maintaining healthy facilities, including improving ventilation; contact tracing in combination with isolation and quarantine, in collaboration with the State, local, territorial, or Tribal health departments; diagnostic and screening testing; efforts to provide vaccinations to school communities; appropriate accommodations for children with disabilities with respect to health and safety policies; and coordination with State and local health officials.

[15] *https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/operation-strategy.html.*

[16] ED COVID–19 Handbook Vol. 2, *Roadmap to Reopening Safely and Meeting All Students' Needs,* page 8, available at: *https://www2.ed.gov/documents/coronavirus/reopening-2.pdf.*

Exhibit Y

3:47

LTE

me 11:26 AM

Hey Mr. Kranzley it's Nolan. I saw that I got a 39/50 thi...

Jonathan Kranzley 1:36 PM

to me

Hi Nolan,
You may have had an unexcused absence for Thursday that now has turned into an excused absence? I grade on participation each day.

I am also grading on your ability to follow expectations. One of the expectations for the school is that you wear your mask. I have asked you about a dozen times to put your mask on.
I look at it as a job. If I am your boss and I have an expectation and you cannot follow it or need to be reminded of it I might not give you a raise, find someone who will, or lower pay for time spent managing the expectation.
Thank you for checking in. Please let me know if you have any other questions or concerns.
Have a good weekend,
Mr. Kranzley

...

Thank you and I will.	Okay, thank you!	Thank you so much!

Reply   Forward

Available add-ons:

Exhibit Y

9:38

◀ Facebook

Done Edit

por favor llame a la escuela en lugar de enviarle un mensaje de texto.

WED 9/29/21 AT 11:25 AM

Taylor Steen

Tri 1 - Per 7 - Health 8 Parents

See reactions

Good Morning. Students have been taught how to wear masks correctly. Starting on Monday, students who are not wearing masks correctly will be given a major referral. Please check in with your student that they have properly fitting masks and can tell you the school expectation of proper

Exhibit Z

wearing.

1

Taylor Steen

Tri 1 - Per 7 - Health 8

Parents

It's outside of office hours

Send a message, photo, or voice clip

More

From: Cory Erickson <ericksonc@nwasco.k12.or.us>
Date: November 15, 2021 at 6:37:45 AM PST
To: Jennifer Gunter <jennof4@gmail.com>
Subject: Re: Adisyn Gunter

Hi Jennifer,
When wearing masks, my classroom is policy is that it needs to cover their mouth and nose at all times, except when they are drinking water. If for some reason their mask falls below their mouth and/or nose I will ask them to put it back over their mask or nose. If it happens again and they do not correct the mask themselves I will give them a minor referral. My students have been doing much better about correcting their masks when that does happen but occasionally I will only have to give them one warning to put their mask back up. I hope that answers your question.

Cory Erickson

10:52

Inbox 11 Messages

Siri found new contact info
Cory Erickson ericksonc@nwasco.k12.or.us add...

Cory Erickson 10:50 AM
To: Jennifer Gunter >

Re: Adisyn Gunter

Hi Jennifer,
Yes, the referral policy for my class is the same. I will make sure to have everything she turns in today updated in PowerSchool.

> On Mon, Nov 15, 2021 at 8:25 AM Jennifer Gunter <jennof4@gmail.com> wrote:
> Thank you for the clarification on that. However, I know school policy is after 3 major referrals or so many minors ones its turned into major referral that it's an in school suspension or either out of school suspension depending on the amount of referrals a kids received, is that correct for your classroom, the referrals would count towards any type of suspension action?

8B House Syllabus

Subject	Teacher	Email	Phone 541-506-3880
Language Arts	Mr. Hughitt	brian.hughitt@nwasco.k12.or.us	Ext. 4200
Math	Mrs. Moreno	morenoa@nwasco.k12.or.us	Ext. 4220
Science	Mrs. DeLeon	deleonk@nwasco.k12.or.us	Ext. 4216
Social Studies	Mr. Rowland	rowlandj@nwasco.k12.or.us	Ext. 4201

Classroom Rules:
All students will be expected to be **ready to learn**.
All students are required to wear masks, all period besides BIC

R E A D Y T O

Listen to instructions.
Enter and exit prepared.
Always try your BEST!
Respect yourself and others.
No Excuses!

Minors/Major Referrals:
According to the *student handbook*, students who are not **ready to learn** and/or are interfering in some way with the learning of others will be given a minor referral. Three minor referrals will result in a major referral managed by the office. Major behavior and/or discipline infractions will be immediately directed to the office. For specific details regarding possible behaviors and consequences please refer to the student handbook or contact us directly.

Technology and Cell Phones:
The TDMS school rule is that **cell phones and headphones/earbuds need to be off and away** so that they are not a distraction. Students may use headphones/earbuds ONLY with teacher permission for an academic purpose,otherwise they should be out of sight. If you need to contact your student during the school day, please call through the main office number. The first violation of the cell phone policy will result in the student turning their phone into the main office, to be picked up by the student at the end of the day. **Any further violations will require a parent/guardian to pick up the student's electronic device at the end of the school day**.

Grading Policy

a. **40% Classwork**: classwork is used to learn and work with the curriculum. All classwork becomes homework if not finished in class and is due the next day unless specified otherwise.
b. **60% Assessments**: Assessments can be retaken ONCE. Assessment retakes must be scheduled in advance. All Unit work must be completed before a retake can be scheduled.

Attendance/ Hall Passes

- Students are expected to be **on time** to class. This means **in the seat** when the bell rings.
  - After three tardies, a consequence will be given to the student. Chronic tardiness will be dealt with using the school behavior plan (see student handbook).
- Students may use a maximum of **2** hall passes per day. This includes any time students need to leave the classroom (bathroom breaks, locker for missing supplies, to the office, etc). Make sure you plan accordingly!

Absent Work/ Late work

- There is a two week deadline to turn in all late work or to retake assessments.
- All students are expected to make up their work when they are absent. Your teachers will have a place to find absent work either somewhere in their rooms or online.
  - It is the *student's* responsibility to get their absent work, any notes needed, and make contact with the teacher.

Academic Integrity/Cheating

Honesty and integrity (doing the right thing) is expected at all times. Plagiarism, taking someone else's words or ideas and passing them off as your own, whether from the internet or another student, is unacceptable and will receive a mark of zero with a request to re-do. Students who are not meeting expectations for academic honesty and integrity will be given an appropriate consequence (often a referral), parents contacted, and asked to resubmit plagiarized work or retake an assessment. **Respect yourself and your classmates by doing the right thing.**

Student Planners

Every student will be given a student planner the first week of school. **It is a school expectation that all students are writing assignments/projects in their planner every day for every class**. Planners are a tool used to not only keep the students organized, but to help with the home to school communication. Planners will be checked in PRIDE classes to assure students are meeting this expectation.

Math

1. Students will need to come to class everyday prepared with a pencil, eraser, math notebook, student planners, and text book.
2. Each student will be responsible for their assigned text book. The text book is available online as well (see link below).
3. It is each student's responsibility to see me for any missed work or to make-up/retake tests or quizzes due to absence, sports, etc.
4. Homework will usually consist of completing classwork. Students are almost always given time in class to work on this, as well as during PRIDE class.

5. TDMS Grading Policy:

A. 40% Classwork/Homework: Completing classwork in a timely manner is essential to learning the foundational skills we will build upon with each new lesson. Homework is due the day after it is assigned. Students have up to 2 weeks beyond the due date to receive credit for assignments.
B. 60% Tests and Quizzes: Tests can be retaken ONCE to improve their score.

6. **Algebra Students** = This is a high school Algebra 1 course. The high school requires students to maintain a C or higher for each trimester in order to be recommended for high school geometry and receive high school credit as an 8th grader. If you have any specific questions or concerns please contact me.

7. Resources:
   A. **classroom.google.com** = Notes and other resources will be available through our Google Classroom.
   B. **corefocusonmath.com** = Students can login and access their textbook, video lessons/tutorials, worksheets to print, and additional resources. Login Id: thedalles Password: eagles123
   C. **Mrs. Moreno** = I am ALWAYS here to help. Students may make an appointment with me before school, after school, at lunch, or during PRIDE. Parents are more than welcome to contact me anytime via my contact information above.

Language Arts

Welcome to Language Arts with Mr. Hughitt. During the course of the 2021\22 school year students will continue developing their skills and concepts of language and communication through writing, reading, speaking, and listening. During the year we will be utilizing various technologies and old world methods (the Internet can break) to conduct research and work through the writing process. In addition, we will be reading novels, short stories, excerpts and attempt inferences towards the author's meaning. Grammar and conventions will be another cornerstone of the class accomplished through student writing.

Grading:

a. 40% Classwork will consist of warmups, exit tickets, writing samples, group work, etc.
b. 60% Assessments (essays, projects, speeches, tests, and quizzes).
   i. Major written work will be graded with the Oregon Department of Education English Language Arts Essential Skills Rubrics. These are broken down into narrative and informative/argumentative rubrics which include the following: ideas and content, organization, voice, word choice, sentence fluency, conventions, and use of sources.
   ii. Any assessment can be redone to demonstrate mastery. However, students must discuss and make a plan on how they will improve with Mr. Hughitt. Making a plan will require student initiative. All re-submissions must be completed two weeks after the due date.

Materials: Students will need to bring a composition notebook, writing utensil (pencil) everyday.

Resources:

1. Google Classroom
2. Newsela

3. http://www.oregon.gov/ode/educator-resources/essentialskills/Pages/Scoring-Guides.aspx
4. Mr. Hughitt will be available to help! Make an appointment before school, after school, or during PRIDE class. <u>Bottom line it is our wish to support your student!</u>

Social Studies

Preview of Units:

1. Intro to 8th Grade Social Studies
2. Age of Exploration
3. Early Colonization (North America)
4. Causes of the American Revolution
5. The American Revolution
6. Creating the Government
7. Slavery Post Revolution/Pre-Civil War
8. Causes of the American Civil War
9. American Civil War
10. Reconstruction

Supplies specific to Social Studies (not mentioned on first page):

- Will need colored pencils/ markers (some available in room as well)

Grading/Absences/Make up:

- Most classwork/class assignments can be completed in class, although if students do not finish in class then they will have to finish either during PRIDE or on their own time.
- Per school policy, ALL work can be turned in up to 2 weeks after the due date for full credit. No work will be accepted after this (including assessments).

Science

<u>Curriculum</u>: **<u>Term 1:</u>** Life Science, **<u>Term 2:</u>** Chemistry, **<u>Term 3:</u>** Physics.

- Stemscopes is our adopted science curriculum. Many assignments, but not all, will be completed on the chromebooks. Computer access at home will be very helpful but not required!
- Students will have an assignment each day. Anything not finished during class, becomes homework. Assignments are due at the beginning of class the next day.

<u>Science Labs</u>

- Labs are used as a learning tool, so students are REQUIRED to make up every lab that they miss.
- Lab safety is a top priority. If a student is unable to be safe during a lab, they will be asked to leave the class without the option to complete the lab.
- Lab Makeups: It is the students responsibility to set up a time to come and make up a lab. This needs to be done within a week of the lab, before or after school.
- Per Oregon Science Safety Requirements: **<u>Food is NOT allowed in the science classroom</u>**.

Supplies- The following is needed everyday in science: Paper, Pencil, Highlighter, Colored Pencils, Glue, **Science Notebook**, headphones, and their school binder and planner. You need a folder in your binder for Science only.

Help Time: I coach Volleyball, so I am not available after school for the first few months of school. After that, I am available on Wednesdays from 3:00 - 4:00pm after school and everyday before school starting at 7:30 if you make an appointment.However, I will have morning duty every 6 weeks. Therefore, will be unavailable for morning help time those weeks.

I have read and understand the policies for the 8th grade House at TDMS.

Student Signature:

Parent Signature:

Exhibit AA

NORTH WASCO COUNTY SCHOOL DISTRICT
JOB DESCRIPTION – Middle Level (Sixth Grade and/or Content Area)

Title: Teacher – Middle School Level (Content Area)

Classification: Licensed

Reports To: Building Principal

Work Year 190 Days/Year

Job Purpose Statement/s:

The job of "Teacher - Classroom (Middle Level)" is done for the purpose/s of developing students' academic and interpersonal skills through academic courses of study and implementing District approved curriculum; documenting teaching and student progress/activities/outcomes; addressing specific educational needs of students; providing a safe and optimal learning environment; providing feedback to students, parents and administration regarding student progress, expectations and goals.

Job Qualifications & Licensure:

- BA/BS or higher degree *(required)* with a major in one or more of the following areas: Curriculum, Elementary Education, Secondary Education, MIDLVL-Multi-Subject, Content Area (Math, Science, Language Arts, Social Studies, Economics, Geography, Biology, Physics, Reading, Early Childhood Education, or similar).
- Valid Oregon Teaching License and endorsement(s) from the Teacher Standards and Practices Commission in the State of Oregon; and displays a willingness to teach any qualified subject area.
- (Must meet Highly Qualified Requirements) with endorsed areas of assignment.
- Skills to motivate students, communicate with individuals from varied educational and cultural backgrounds, direct support personnel, evaluate performance.
- Knowledge of age appropriate teaching methods, state curriculum framework, education code, appropriate instructional subjects.

Skills, Knowledge and/or Abilities

- Provide a variety of classroom techniques and methods.
  - Promote high levels of achievement in relation to individual student abilities.
  - Use techniques and methodologies appropriate to student abilities.
  - Utilize current and relevant subject matter.
- Demonstrate knowledge of and abilities to use research-based principles of effective instruction.
  - Organize instruction using learning objectives with clearly defined student outcomes.
  - Employ teaching strategies congruent with planned student outcomes.
  - Select teaching strategies emphasizing student involvement.
  - Monitor student learning and pace instruction accordingly.
- Develop and maintain an environment conducive to effective student learning.
  - Develop written rules of classroom behavior and communicate those rules to all students.
  - Enforce written rules for classroom behavior.
  - Communicate course goals and academic expectations to students.
  - Provide for the health and safety of student in all instructional settings.
- Prepare effectively for class
  - Prepare daily lesson plans.
  - Provide instruction predicated on course goals objectives, aligned with district adopted standards.
- Develop and communicate appropriate grading standards to students
  - Establish written grading standards that are clear and incorporate a variety of graded activities.
  - Assure that grading standards are explained and available to parents.
- Develop and maintain positive interpersonal relationships
  - Model personal behaviors of honesty, fairness, courtesy consideration, respect, and cultural awareness and responsibility.

Exhibit AA

  - Maintain a cooperative relationship with administration, staff, students and parents.
  - Share appropriate information with parents and with other staff members.
- Provide documentation of students' progress
  - Provide timely and accurate feedback/documentation to students, parents, and appropriate staff members.
  - Assign and check homework and provide feedback to students.
  - Maintain appropriate records of student performance.
- Build motivation and interest in learning
  - Exhibit personal interest and encourage student interest in the subject area.
  - Maintain a current awareness of literature/activities in subject area.
- Maintain an ongoing personal program of professional growth and development.
  - Develop and implement annually an approved plan for professional growth and development.
  - Identify and request to attend professional workshop activities intended to increase the teacher's instructional effectiveness.
  - Participate in District sponsored in service offerings appropriate to assignment.
- Maintain an ongoing personal program of professional growth and development.
  - Develop and implement annually an approved plan for professional growth and development.
  - Identify and request to attend professional workshop activities.
  - Participate in District sponsored in-service offerings appropriate to assignment.
- Maintain an attitude of helping in the total school atmosphere.

This organization believes that every individual makes a significant contribution to our success. That contribution should not be limited to assigned responsibilities. Therefore, this position description is designed to define primary duties, qualifications and job scope but should not limit the incumbent nor the organization to the work identified. It is our expectation that every employee will offer his/her services wherever and whenever necessary to ensure the success of the District's goals.

Workplace Expectations:

- Work effectively with and respond to people from diverse cultures or backgrounds.
- Demonstrate professionalism and appropriate judgment in behavior, speech and dress in a neat, clean and appropriate professional manner for the assignment and work setting.
- Have regular and punctual attendance.
- Confer regularly with other licensed staff and immediate supervisor.
- Follow all District policies, work procedures and reasonable requests by proper authority.
- Maintain the integrity of confidential information relating to a student, family, colleague or District patron.

PHYSICAL REQUIREMENTS:

1. In an eight-hour day employee may:

a. Stand/Walk	{ }None { }1-4 hrs	{x}4-6 hrs	{ }6-8 hrs
b. Sit	{ }None { }1-3 hrs	{ }3-5 hrs	{x}5-8 hrs
c. Drive	{ }None { }1-3 hrs	{ }3-5 hrs	{x}5-8 hrs

2. Employee may use hands for repetitive:
{x}Single Grasping {x}Pushing and Pulling {x}Fine Manipulation

3. Employee may use feet for repetitive movement as in operating foot controls:
{ }Yes {x}No

4. Employee may need to:

a. Bend	{ }Frequently	{x}Occasionally	{ }Not at all
b. Squat	{ }Frequently	{x}Occasionally	{ }Not at all
c. Climb Stairs	{ }Frequently	{x}Occasionally	{ }Not at all
d. Lift	{ }Frequently	{x}Occasionally	{ }Not at all

5. Lifting:

{ } Sedentary Work: Lifting 10 pounds occasionally with frequent sitting and occasional standing/walking.
{ } Light Work: Lifting 20 pounds occasionally with occasional sitting and frequent standing/walking.
{x} Medium Work: Lifting 50 occasionally, 25 pounds frequently with occasional sitting and frequent standing/walking.
{ } Medium Heavy Work: Lifting 75 pounds occasionally, 35 pounds frequently with occasional sitting and frequent standing/walking.
{ } Heavy Work: Lifting 100 pounds occasionally, 50 pounds frequently with occasional sitting and frequent standing/walking.

Mandatory Child Abuse Reporting: As mandatory reporter (ORS.419b.010) you are required to immediately report to Law Enforcement and or Department of Human Services, any instances of suspected child abuse.
I have read and received a copy of this job description, and understand that a copy of this job description will become part of my personnel file.

EMPLOYEE STATEMENT:

"I have reviewed the above position and understand its content. I am aware that my position description may be revised or updated at any time and once notified of changes, I remain responsible for knowledge of its contents.

I hereby certify that I possess the physical and mental ability to fulfill the essential responsibilities of the above position with or without reasonable accommodation(s). If I require accommodations(s) in order to fulfill any or all of these responsibilities, I agree to provide information to the District regarding the requested accommodation(s)."

____

Print Name

____________________________________ ____________________________________

Employee Signature Date

Exhibit AB

Wasco County Schools

To all concerned,

This letter of intent to sue shall serve as a formal notice that Jennifer R Gunter parent of Nicholas Gunter and Adisyn Gunter intends to commence a lawsuit against you on behalf of her minor children and herself. Please retain all communication between all parties in deciding to re-enact the unconstitutional declaration that you wish to illegally enforce.

The Lawsuit will be seeking damages and remedy for and not limited to: unauthorized restrictions of liberty; Identifying a minor as a potential public health risk with no jurisdiction; Identifying and declaring a minor as a potential public health risk with no evidence; Declaring mandates to restrict a minor's liberty with no legal jurisdiction; Declaring mandates that have NO LEGAL jurisdiction to restrict civil liberties; Declaring mandates imposing dress code that does not align with DRESS CODE regulations; Declaring mandates as Medical experts; Depriving students and parents civil liberties with no authority;

Article 1 of the Oregon state Constitution:

Section 1. Natural right inherent in the people. We declare that all men, when they form a social compact are equal in right: that all power is inherent in the people, and all free governments are founded on their authority, and instituted for their peace, safety and happiness; and they have at all times a right to alter, reform or abolish the government in such manner as they may think proper. -

You have violated my rights as a parent and my minor children's inherent rights by adopting such measures without due process in law as well as not suppling adequate proof that a minor child needs to be masked or poses a health risk.

Governmental, educational and heath departments have no legal authority to co parent my minor children or household.

School districts simply don't have the authority to issues laws of general applicability concerning health issues such as this. We, I, our household and minor children have NOT forfeited any explicit right that any private or federal agency have RIGHTS over our dominion and that of my minor children and therefore those rights are powers reserved to the people.

You are not an authority, and you will either RESCIND your declaration or we will take this matter to the HIGHEST of courts.

I will be seeking a TEMPORARY RESTRAING ORDER if the "mandate" is not rescinded by close of business day October 22, 2021

Exhibit AB

I do not consent to our or my minor children's civil liberties being violated. To be clear, my children and I are reserving our rights to assert claims under the US and Oregon Constitution. Again, let this serve as notice of intent to sue D21 and all school board members individually if masking our children is not rescinded by October 22, 2021.

Regards,
Jennifer R. Gunter

To all concerned,

This letter of intent to sue shall serve as a formal notice that Robert Jay Schwartz, parent of Jace Theo Browning-Schwartz intends to commence a lawsuit against you on behalf of his minor child and himself. Please retain all communication between all parties in deciding to re-enact the unconstitutional declaration that you wish to illegally enforce.

The Lawsuit will be seeking damages and remedy for and not limited to: unauthorized restrictions of liberty; Identifying a minor as a potential public health risk with no jurisdiction; Identifying and declaring a minor as a potential public health risk with no evidence; Declaring mandates to restrict a minor's liberty with no legal jurisdiction; Declaring mandates that have NO LEGAL jurisdiction to restrict civil liberties; Declaring mandates imposing dress code that does not align with DRESS CODE regulations; Declaring mandates as Medical experts; Depriving students and parents civil liberties with no authority;

Article 1 of the Oregon state Constitution:

Section 1. Natural rights inherent in the people. We declare that all men, when they form a social compact are equal in right: that all power is inherent in the people, and all free governments are founded on their authority, and instituted for their peace, safety and happiness; and they have at all times a right to alter, reform or abolish the government in such manner as they may think proper. -

You have violated my rights as a parent and my minor child's inherent rights by adopting such measures without due process in law as well as not supplying adequate proof that a minor child needs to be masked or poses a health risk.

Governmental, educational and health departments have no legal authority to co parent my minor child or household.

School districts simply don't have the authority to issue laws of general applicability concerning health issues such as this. Our household and minor child have NOT forfeited any explicit right that any private or federal agency has RIGHTS over our dominion and that of my minor child and therefore those rights are powers reserved to the people.

You are not an authority, and you will either RESCIND your declaration or we will take this matter to the HIGHEST of courts.

I will be seeking a TEMPORARY RESTRAINING ORDER if the "mandate" is not rescinded by close of business day October 22, 2021

I do not consent to my minor child's civil liberties being violated. To be clear, my child and I are reserving our rights to assert claims under the US and Oregon Constitution.
Again, let this serve as notice of intent to sue D21 and all school board members individually if masking our children is not rescinded by October 22, 2021.

Respectfully;

Robert Schwartz

North Wasco County School Board

To all parties concerned,

This ***2nd revised*** letter of intent to sue shall replace the prior letter and serve as a formal notice that Holly Gove, parent of Madison Gove intends to commence a lawsuit against you on behalf of her minor child and herself. Please retain all communication between all parties in deciding to continue the unconstitutional mandates that you have been illegally enforcing.

The lawsuit will be seeking remedy and damages for and not limited to: Identifying and declaring a minor as a potential health risk with no supporting evidence to such declarations; issuing mandates directly restricting a minor's civil liberties with no jurisdiction; declaring mandates that restrict civil liberties irrespective of the public's concerns brought forward regarding the health and mental ramifications of prolonged masking, violations of the Oregon State Constitution which each and every board member swore under oath to protect and follow upon accepting a district board position; declaring health mandates as medical experts: denying students and parents civil liberties with no authority.

You have repeatedly violated my rights as a parent and my minor child's inalienable rights by adopting such mandates without due process in law as well as not providing adequate proof that the minor child needs to be masked or poses a health risk.

REFER TO ARTICLE 1 SECTION 1 OF THE OREGON STATE CONSTITUTION
RE: Natural rights inherent in the people and that Governments exist only by OUR authority and for OUR peace, safety and happiness and we reserve the right to reform or remove unlawful governments in any manner we see fit.

School Districts simply do not have the authority to issue laws of general applicability in this manner. I and my minor child have NOT forfeited any explicit right that any private or federal agency has rights over my dominion and that of my minor child and therefore those rights are powers reserved to me as parent.

You are not an authority, you do not make medical decisions for my minor child, and you will rescind your unlawful masking policy that continues to violate my child's constitutional rights and liberties, or we will take this matter to the HIGHEST courts.

I DO NOT CONSENT to I or my minor child's civil liberties being violated.

Let this serve as official notice of intent to sue D21 and all individual school board members if the mandate to mask my child is not rescinded by ***OCTOBER 22nd 2021.***

19 October 2021

North Wasco County School

To All Concerned

This letter of intent to sue shall serve as a formal notice that Chelsea Elizabeth Perritt (parent of Lillian AG Perritt) intends to commence a lawsuit against you on behalf of the minor and herself. Please retain all communications between all parties in deciding to enact the unconstitutional declaration that you wish to illegally enforce.
The lawsuit will be seeking damages and remedy for and not limited to: Unauthorized restrictions of liberty; Identifying a minor as a potential public health risk with no jurisdiction; Identifying and declaring a minor as a potential public health risk with no evidence; Declaring mandates to restrict a minor's liberty with no legal jurisdiction; Declaring mandates that have NO LEGAL jurisdiction to restrict civil liberties; Declaring mandates imposing dress code that does not align with DRESS CODE regulations; Declaring mandates as MEDICAL experts; Depriving students and parents civil liberties with no authority;

Article I of the Oregon State Constitution:
Natural rights inherent in people. We declare that all men, when they form a social compact are equal in right: that all power is inherent in the people, and all free governments are founded on their authority, and instituted for their peace, safety, and happiness; and they have at all times a right to alter, reform, or abolish the government in such manner as they may think proper.

School districts simply don't have authority to issue laws of general applicability concerning health issues such as this. We have NOT forfeited any explicit right that any private or federal agency have RIGHTS over our dominion and that of our children and therefore those rights are powers reserved to the people.
In addition, the SCHOOL BOARD under NO CIRCUMSTANCES can invoke such authority on its own.

You have violated my rights as a parent and my minor children's inherent rights by adopting such measures without due process in law, as well as not suppling adequate proof that a minor child needs to be masked or poses a health risk. You constantly listen to one sided arguments and not full picture.

Governmental, educational and heath departments have no legal authority to co parent my minor children or household.

You are not an authority and you will either RESCIND your declaration, or we will take this matter to the HIGHEST of courts while suing EACH and every one of you. This is a direct violation of civil liberties on a state and national level.

I will be SEEKING A TEMPORARY RESTRAINING ORDER if the "mandate" is not rescinded by close of BUSINESS DAY on 22 October 2021.

I am letting you know right now, my child will not be wearing a mask, will not be forced to wear one because I DO NOT CONSENT nor did a public open discussion occur. To be clear, my daughter and I are reserving our rights to assert claims under the US and Oregon Constitution.

Sincerely yours,
Chelsea Elizabeth Perritt

Exhibit AC

DECLARATION OF STEPHEN E. PETTY, P.E., C.I.H., C.S.P.

NOW **COMES STEPHEN E. PETTY, P.E., C.I.H., C.S.P.**, who states as follows:

1. I am an adult in sound mind and body. I am competent to make this declaration. I have personal knowledge of the facts stated herein.

2. Since April 14, 1996, I have owned and operated EES Group, Inc., a forensic engineering and consultancy specializing in health and safety.

3. I hold relevant industry certifications including C.I.H. (Certified Industrial Hygienist), C.S.P. (Certified Safety Professional), and as a P.E. (Professional Engineer) in six states (Florida, Kentucky, Ohio, Pennsylvania, Texas, and West Virginia). My curriculum vitae is attached as **Exhibit i**.

4. I have served as an expert in personal protective equipment and related disciplines in approximately 400 legal cases. I have often been certified as, and provided testimony as, an expert in these areas. My list of representative cases is attached as **Exhibit ii**.

5. For example, I am currently serving as an expert in the Monsanto Roundup, DuPont C-8, and 3-M PFAS litigation. Recently I testified in four trials related to the Dupont C-8 litigation.

Exhibit AC

6. I taught Environmental and Earth Sciences as an adjunct professor at Franklin University.

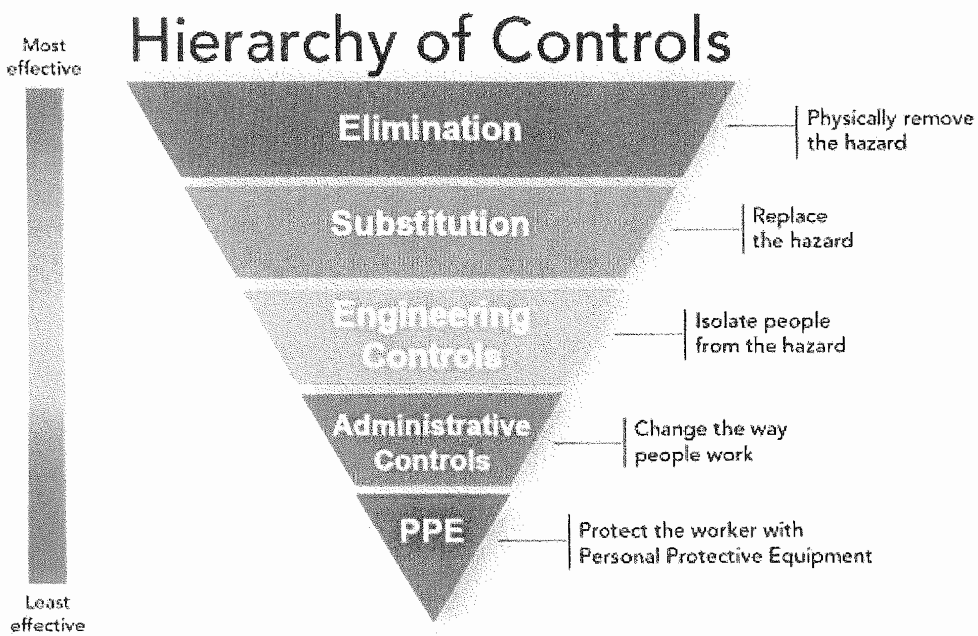
7. I hold nine U.S. patents, most related to heating, ventilation, and air conditioning systems.

8. I am a current member in good standing of the following relevant associations: American Industrial Hygiene Association (AIHA), American Board of Industrial Hygiene (ABIH), American Conference of Governmental Ind. Hygienists (ACGIH), American Institute of Chemical Engineers (AIChE), American Society of Refrigeration, Air Conditioning and Refrigeration Engineers (ASHRAE); Member ASHRAE 40 Std. and TC 2.3, and Sigma Xi.

9. I am an expert in the field of Industrial Hygiene, which is the science and art devoted to the anticipation, recognition, evaluation, and control of those environmental factors or stressors — including viruses — arising in or from the workplace, which may cause sickness, impaired health and well-being, or significant discomfort among workers or among the citizens of the community.

10. Industrial Hygiene is fundamentally concerned with the proper methods of mitigating airborne/dermal hazards and pathogens, as well as with the design and use of personal protective equipment, among other things.

11. Industrial hygienists refer to a "Hierarchy of Controls" that are typically implemented to minimize exposures, including exposures to very small airborne aerosols like SARS-CoV-2, the virus that causes COVID-19.



12. Regarding practical or "engineering" controls, industrial hygienists focus on practices that dilute, destroy, or contain airborne hazards (or hazards in general).

13. Personalized Protective Equipment (PPE) — especially facial coverings — do not dilute, destroy, or contain airborne hazards. Therefore, facial coverings are not part of the Industrial Hygiene (IH) Hierarchy of Controls. Even respirators (part of the PPE Category and classified separately from masks) are in the last priority on the Hierarchy of Controls.

14. Medical doctors, virologists, immunologists, and many public health professionals are experts at how a virus behaves inside the human body, but not qualified experts in how the virus behaves outside of the human body. This is the purview of industrial hygiene and infection control.

15. On May 7, 2021, the Centers for Disease Control (CDC) updated its guidance, providing that the primary mechanism for transmission of Covid-19 is through airborne aerosols, and not as the CDC previously stated, by touching contaminated surfaces or through large respiratory droplets.[1]

16. Airborne viral aerosols can consist of a single viral particle or multiple viral particles clumped together, and usually smaller than 5 μm (microns) in size. Covid aerosols are 0.1 μm in size. By comparison, droplets are >5 μm to >10 μm in size.

17. A square micron is approximately 1/4000th the area of the cross-section of a human hair and 1/88th the diameter of a human hair. SARS-CoV-2 particles are ~1/10 of a micron or ~1/40,000th the area of a cross section of a human hair or ~1/880th the diameter of a human hair.

[1] **Exhibit iii.** https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/sars-cov-2-transmission.html

18. A recent University of Florida study capturing air samples within an enclosed automobile cabin occupied by a Covid-positive individual showed that the only culturable Covid-19 virus samples obtained were between 0.25 μm to 0.5 μm in size.[2] Particles smaller than 5 μm are considered very small and/or very fine or aerosols.

19. Very small particles do not fall by gravity in the same way that larger particles can and do stay suspended in still air for a long time, even days to weeks.

20. Because they stay suspended in concentration in indoor air, very small particles can even accumulate and become more concentrated over time if the ventilation is poor.

21. Very small airborne aerosols pose a particularly great risk of exposure and infection because, since they are so small, they easily reach deep into the lung. This explains in part why Covid-19 is so easily spread, and why so little Covid-19 is required for infection.

22. Exposure to airborne aerosols is a function of two primary parameters: concentration and time. Less is better regarding both parameters. However, in a school environment, it is difficult to limit the amount of time students spend in a classroom.

[2] **Exhibit iv**. Lednicky, John A. et al. "Isolation of SARS-CoV-2 from the air in a car driven by a COVID patient with mild illness." *International Journal of Infectious Diseases*, Vol. 108, P212-216, July 1, 2021. DOI: https://doi.org/10.1016/j.ijid.2021.04.063 .

23. For many reasons, personal protective equipment (PPE) is the least desirable way to protect people from very small airborne aerosols. A device referred to as a respirator (commonly referred to as an N95 Respirator) is required to provide such protection. Moreover, masks are not PPE since they cannot be sealed and do not meet the provisions of the Occupational Safety and Health Administration (OSHA) Respiratory Protection Standard (RPS), namely 29 CFR 1910.134.[3]

24. The AIHA, in its September 9, 2020 Guidance Document for COVID-19 noted that only risk reduction methods that provide greater than a 90% relative risk reduction should be considered; masks were shown to provide no great than a 10% relative risk reduction (see Figure 2), and far below the required 90% threshold.[4]

25. Similarly, a paper published on July 21, 2021 in the Journal *Physics of Fluids*, using ideally sealed masks and particles 1 μm in size, reported efficiencies for the more commonly used cloth masks and surgical masks of 10% and 12%, respectively.[5] No mask can be perfectly sealed; thus "real world" effectiveness – particularly for children - is even lower.

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[3] https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.134 (*accessed September 24, 2021*)

[4] **Exhibit v.** https://aiha-assets.sfo2.digitaloceanspaces.com/AIHA/resources/Guidance-Documents/Reducing-the-Risk-of-COVID-19-using-Engineering-Controls-Guidance-Document.pdf (*see FIG. 2*)

[5] **Exhibit vi.** Shah, Yash et al. "Experimental investigation of indoor aerosol dispersion and accumulation in the context of COVID-19: Effects of masks and ventilation." Phys. Fluids 33, 073315 (2021); https://doi.org/10.1063/5.0057100 .

26. Facial coverings are not comparable to respirators. Leakage occurs around the edges of ordinary facial coverings. According to the CDC's National Institute for Occupational Safety and Health, surgical masks "do NOT provide the wearer with a reliable level of protection from inhaling smaller airborne particles and is not considered respiratory protection. Leakage occurs around the edge of the mask when the user inhales."

27. Thus, ordinary facial coverings do not provide a reliable level of protection against inhalation of very small airborne particles and are not considered respiratory protection. The inability of the masks to achieve proper fit is particularly pronounced in children.

28. For example, during the seasonal forest fires in the summer of 2020, the CDC issued public guidance warning that facial coverings provide no protection against smoke inhalation. That is because facial coverings do not provide a reliable level of protection against the small particles of ash contained in smoke. Ash particles are substantially larger than Covid-19 aerosolized particles.

29. I have reviewed the Oregon Department of Education (ODE) and Oregon Health Authority (OHA) facial covering rules, guidance and policies[6]; which mandate that

[6] ODE & OHA joint document titled *Ready Schools, Safe Learners Resiliency Framework for the 2021-22 School Year* (updated September 9, 2021; https://www.oregon.gov/ode/students-and-family/healthsafety/Documents/Ready%20Schools%20Safe%20Learners%20Resiliency%20Framework%20for%20the%202021-22%20School%20Year.pdf accessed October 22, 2021); ODE document titled

children wear masks at all times while indoors at school, as well as requiring children wear masks while participating in many outdoor activities.

30. Ordinary facial coverings like the ones required by the ODE and OHA mask mandates do not meet any of the several key OSHA Respiratory Protection Standards (RPS) for respirators.

31. Because of the gaps around the edges of facial coverings required by ODE and OHA rules and policies, they do not filter out Covid-19 aerosols.

32. Most over-the-counter disposable facial coverings have edge gaps of 10% or more. When adult-sized facial coverings are used by children, edge gaps will usually greatly exceed 10%. Ordinary facial coverings like the ones required by the ODE and OHA rules and policies do not provide any filtering benefit relative to particles smaller than 5 μm, if not properly sealed.

33. One study found that for aerosols < 2.5μm, mask filtration efficiency decreases by 66% for a relative leak area of 2%.[7] Therefore, the effectiveness of a facial

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Schools and Face Coverings Frequently Asked Questions (FAQ) (dated October 2021; https://www.oregon.gov/ode/students-and-family/healthsafety/Documents/Schools%20and%20COVID-19%20FAQ.pdf accessed October 22, 2021); OHA document titled *Indoor and Outdoor Masking FAQs* (updated 9-17-2021; https://sharedsystems.dhsoha.state.or.us/DHSForms/Served/le3818.pdf accessed October 22, 2021); OAR 333-019-1015 (https://secure.sos.state.or.us/oard/viewSingleRule.action?ruleVrsnRsn=280834 accessed October 22, 2021); OAR 333-019-1025 (https://secure.sos.state.or.us/oard/viewSingleRule.action?ruleVrsnRsn=280702 accessed October 22, 2021).

[7] **Exhibit vii**. F. Drewnick, J. Pikmann, F. Fachinger, L. Moormann, F. Sprang, S. Borrmann, Aerosol filtration efficiency of household materials for homemade face masks: Influence of material properties,

covering falls to essentially zero when there is a 3% or more open area in the edges around the sides of the facial covering.

34. The following pictures are cropped still frames from a video embedded in a KDRV news story entitled *Schoolwatch: Full-Time In Person Learning Resumes For Medford School District*[8]. The video shows students from Wilson Elementary (in Medford, Oregon) being instructed on August 23, 2021 by a second grade teacher; then of the teacher being interviewed on the same day, while on school property. Shown are typical large gaps on both sides of the mask, which can exceed 10%, making the masks completely ineffective. Note the mask on the student to the left is below her nose rendering it even less effective.

(students)

particle size, particle electrical charge, face velocity, and leaks. Aerosol Sci. Technol. 55, 63–79 (2021) https://doi.org/10.1080/02786826.2020.1817846 .

[8] https://www.kdrv.com/content/news/School-Watch-575158951.html (accessed October 22, 2021).

(teacher)

35. Prominently displayed on the Oregon Health Authority webpage[9] promoting the continued use of masks or cloth face coverings (including K-12 classrooms) is an embedded video from Multnomah County Health Department entitled Face Coverings Are Still Important[10]. At time 1:48, disposable medical masks are shown on screen, while the voice of the county health official admits, "…disposable masks are not designed to fit tightly…".

36. SARS-CoV-2 particles could immediately be substantially mitigated by:

a. opening windows and using fans to draw outdoor air into indoor spaces (diluting the concentration of aerosols),

b. setting fresh air dampers to maximum opening on HVAC systems,

[9] https://govstatus.egov.com/or-oha-face-coverings (accessed October 22, 2021).
[10] https://www.youtube.com/watch?v=u_IrGJjwA_0 (accessed October 22, 2021).

c. overriding HVAC energy controls,

d. increasing the number of times indoor air is recycled,

e. installing needlepoint ionization technology to HVAC intake fans, and

f. installing inexpensive ultraviolet germicide devices into HVAC systems.

37. All of the above-referenced techniques are more effective and meet standard Industrial Hygiene Hierarchy of Controls (practices) for controlling exposures. The Hierarchy of Controls has been in place for nearly 100 years.

38. The use of cloth facial coverings does not fit within the basic Hierarchy of Controls since cloth face coverings and masks are not PPE and cannot be sealed. There are no OSHA standards for facial coverings (masks) as respiratory protection.

39. Extended use of respiratory PPE is not indicated without medical supervision.

40. There are a wide variety of well-known negative effects from wearing masks that have been thoroughly studied and reported for years. As explained in a paper published on April 20, 2021 in the *International Journal of Environmental Research and*

Public Health reviewing 44 experimental studies and 65 publications on adverse effects from masks, measurable physical effects including increased heart rates, respiratory rates and elevated CO2 retention were noted even from wearing surgical masks for as few as 30 minutes.[11]

41. In one of the referenced studies of 12 healthy young students, investigators observed dizziness, listlessness, impaired thinking and concentration problems when wearing masks.[12]

42. The paper summarized a lengthy list of negative effects from wearing masks that were reported in the literature, as follows:

Increased risk of adverse effects when using masks:

Internal diseases COPD Sleep Apnea Syndrome advanced renal Failure Obesity Cardiopulmonary Dysfunction Asthma	**Psychiatric Illness** Claustrophobia Panic Disorder Personality Disorders Dementia Schizophrenia helpless Patients fixed and sedated Patients	**Neurological Diseases** Migraines and Headache Sufferers Patients with intracranial Masses Epilepsy
Pediatric Diseases Asthma Respiratory diseases Cardiopulmonary Diseases Neuromuscular Diseases Epilepsy	**ENT Diseases** Vocal Cord Disorders Rhinitis and obstructive Diseases **Dermatological Diseases** Acne Atopic	**Occupational Health Restrictions** moderate / heavy physical Work **Gynecological restrictions** Pregnant Women

Figure 5. Diseases/predispositions with significant risks, according to the literature found, when using masks. Indications for weighing up medical mask exemption certificates.

[11] **Exhibit viii.** Kisielinski, Kai et al. "Is a Mask That Covers the Mouth and Nose Free from Undesirable Side Effects in Everyday Use and Free of Potential Hazards?." *International Journal of Environmental Research and Public Health*, vol. 18, 8 4344. 20 Apr. 2021, doi: 10.3390/ijerph18084344 (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8072811/

[12] *Id.* at 7.

Example statements made in the paper include the following: "The overall possible resulting measurable drop in oxygen saturation (O_2) of the blood on the one hand and the increase in carbon dioxide (CO_2) on the other contribute to an increased noradrenergic stress response, with heart rate increase and respiratory rate increase, in some cases also to a significant blood pressure increase." In fact, "Neither higher level institutions such as the WHO or the European Centre for Disease Prevention and Control (ECDC) nor national ones, such as the Centers for Disease Control and Prevention, GA, USA (CDC) or the German RKI, substantiate with sound scientific data a positive effect of masks in the public (in terms of a reduced rate of spread of COVID-19 in the population)." For these reasons, students who are required to wear masks pursuant to a mandate suffer immediate and irreparable injury, loss, or damage.

43. The authors note: "The overall possible resulting measurable drop in oxygen saturation (O2) of the blood on the one hand and the increase in carbon dioxide (CO2) on the other contribute to an increased noradrenergic stress response, with heart rate increase and respiratory rate increase, in some cases also to a significant blood pressure increase."[13]

44. In summarizing their findings, the authors conclude "…there are clear, scientifically recorded adverse effects for the mask wearer, both on a psychological and on a social and physical level."[9]

[13] *Id.* at 7.

45. For these reasons, students who are required to wear cloth face coverings or masks in school pursuant to ODE and OHA rules, policies and guidance will likely suffer immediate and ongoing injury, both psychological, social and physical – which is detrimental to the learning environment.

46. A recent summary of the literature on these topics shows:

a. PPE is the least desirable way to protect people from very small airborne aerosols.

b. Cloth facial coverings as required by ODE and OHA rules, policies and guidance are not recognized as PPE since they cannot be sealed and are not covered by the OSHA RPS.

c. If PPE were to be used for protection, respirators, not facial coverings as required by ODE and OHA, are needed to provide any effective protection from very small airborne aerosols.

d. Very small aerosol particles are more likely to be a greater cause of disease than respiratory droplets because they can evade PPE and reach deep into the lungs, whereas respiratory droplets have to work against gravity in order to travel up a person's nose into the sinus and typically rapidly fall to the ground.

e. Much better alternatives to controlling exposure are available (i.e., engineering controls of dilution – ventilation and destruction), and should be used to minimize exposures as opposed to masks.

f. Based on cited literature, individuals who are required to wear cloth face coverings or masks pursuant to a mandate have the known potential to suffer immediate and irreparable injury due to a measurable drop in oxygen saturation of the blood and increased carbon dioxide saturation levels, which contribute to an increased noradrenergic stress response, with associated heart rate and respiratory rate increases, and in some cases, a significant blood pressure increase.

I declare under penalty of perjury that the foregoing is true and correct. Executed this 26th day of October, 2021, at 1701 E. Atlantic Blvd., Suite 5, Pompano Beach, Florida, 33060.

Stephen Petty

STEPHEN E. PETTY, P.E., C.I.H., C.S.P.

 EXHIBIT i

Mr. Stephen E. Petty, P.E., C.I.H., C.S.P. President

Company

EES Group, Inc.
(d/b/a - Engineering & Expert Services, Inc.)
1701 E. Atlantic Blvd., Suite 5
Pompano Beach, FL 33060

Education

B.S., Chemical Engineering, University of Washington

M. S., Chemical Engineering, University of Washington

M.B.A., University of Dayton

Experience

General

Mr. Petty is President of EES Group, Inc. (Engineering & Expert Services, Inc.). He started EES Group, Inc. in 1996, ultimately having offices in Ohio (Columbus and Cleveland) and in Florida (Pompano Beach). In 2015, he sold the Ohio portion of EES Group, Inc. while retaining Florida operations. Prior to starting EES Group, Inc. in 1996, Mr. Petty was the Manager of Residential and Commercial Technology at Columbia Energy and a Senior Research Engineer at Battelle. He has 37 years of forensic engineering, environmental health and safety, and energy experience. Since 2002, he has completed or supervised over 7,000 engineering forensic and health and safety projects for nearly 100 clients. This culminated in the writing of a Forensic Engineering textbook targeted at assessing claims for the insurance industry (*Forensic Engineering: Damage Assessments for Residential and Commercial Structures*, January 3, 2013, CRC Press publication; 2nd Edition to issue in 2022).

Mr. Petty's health and safety experience has focused on projects for the legal community (expert witness), the insurance industry, institutions, and the private sector.

His expertise covers the area of Professional Engineering (PE's in six states), Industrial Hygiene (registered Certified Industrial Hygienist - CIH) and safety (registered Certified Safety Professional - CSP). As a CIH, he investigates the causes/solutions of an individual's sickness, impaired health, and discomfort at work and in the home. As a CSP, he investigates situations primarily arising out of possible Occupational Safety and Health Administration (OSHA) violations associated with workplace injuries. In other cases, this extends to customers injured at facilities where they are working or shopping. Finally, he is a certified Asbestos Evaluation Specialist in Ohio.

Mr. Petty has been involved in ~400 expert witness cases to date, with a primary focus on exposure to organic chemicals, inorganic chemicals, pesticides, PFOA, PFAS, mold, bacteria (Legionella), heat and bio-toxins; OSHA workplace compliance (chemical exposures, amputations, and slips, trips and falls, and building envelope systems). He has also supported/testified on building envelope, water cause and origin, structural, and roof damage claims. His company assembled a nine-member team of experts that won the expert witness contract for the Ohio School Facilities Commission (OSFC) from 2004-2008.

Exhibit i

Mr. Petty has extensive expertise on heating, ventilation and air conditioning (HVAC) systems and holds nine (9) U.S. patents primarily related to HVAC systems.

His safety and environmental experience also includes completion of many complex projects in Risk Assessment (BUSTR, EPA and VAP), Industrial Hygiene, Process Safety Management (PSM), Risk Management Plans (Health and Safety Audits), Environmental Assessments (EA) and Environmental Impact Statements (EIS), and air and water permits (PTI, PTO, NPDES, etc.) for numerous clients across the United States.

Finally, he has served in a leadership role in technology evaluations, business plans, and product development activities for dozens of products and ventures. He has been the invited dinner/lunch speaker to ASHRAE/AIHA and legal association functions.

Health and Safety Experience

➢ Mr. Petty has been utilized as an expert witness in ~400 cases primarily related to human exposure(s) and safety (OSHA). In the exposure area, he has worked/ testified on cases of exposure to acid gases, benzene, isocyanates, formaldehyde, gasoline, paint products, other organic chemicals, PFOA/PFAS silica, pesticides, Legionella and other bacteria and molds. In the safety area, he has worked/testified in worker exposure to chemicals, falls, and amputation cases and the standard of care required to protect workers and customers. He is recognized for his ability to reduce complex sets of information regarding exposure and compliance with regulatory standards into simple but accurate reports and presentations. Areas of practice include:

- Occupational Safety and Health Administration Regulations:
  - OSHA Health and Safety Regulations for Workers 29 CFR 1910 General Industry and 29 CFR 1926 Construction Industry
  - OSHA Process Safety Management of Highly Hazardous Chemicals - 29 CFR 1910.119
  - Personal Protective Equipment - PPE - 29 CFR 1910.132
  - Respiratory Protection Standard - 29 CFR 1910.134 and preceding/current ANSI Z88 Standards.
  - 29 CFR 1910.1000 - OSHA PEL and Controls Standard
  - 29 CFR 1910.1028 - Benzene Standard
  - Hazard Communication Standard - HAZCOM - 29 CFR 1910.1200 and preceding/current ANSI Z129.1 (Precautionary Labeling), ANSI Z400.1 (MSDS Preparation) and LAPI Industry Standards (7 Editions from 1945 forward).
- Mine Safety Health Administration (MSHA) EH&S Regulations - 30 CFR Parts 1 to 199
- United State Environmental Protection Agency - USEPA - 40 CFR (Including pesticides, hazardous wastes, permitting, remediation, and Process Safety Management).

- DOT Transportation Regulations and Spill Response - Hazardous Waste Operations and Emergency Response (HAZWOPER) - 46 CFR.

Mr. Petty is also trained in Hazardous Waste Operations and Emergency Response (HAZWOPER) (40-hr.) and has served as a trainer for the 40-hr. course.

- Mr. Petty is a recognized expert in Risk Assessment (RA) having been one of 14 to take the first Risk Assessment courses offered by the Ohio State University & University of Cincinnati Schools of Public Health in 1997. In addition to having completed a dozen risk assessments, he was selected by the State of Ohio Bureau of Storage Tank Regulators (BUSTR) to help write their 1999 UST RA regulations. He was selected to train BUSTR staff RA (5-week course) and to help write the on-line RA webpage, proof the equations, and to help with the online help handbook.

- He has completed dozens of indoor air sampling projects for residential, commercial, and industrial clients. Clients include Grange Insurance Company, Northwest Local School District, Children's Hospital, Berger Hospital, Citgo, Salem University, and Nestle.

- He has completed dozens of mold field evaluation projects. In this area, he attended a one-week ACGIH mold course in late 2002. He also received his residential mold inspector credentials from the IESO in 2003.

- Examples of specific projects completed are:

  - Conducted worker illness IAQ program where Iraqi documents were being scanned. Sampled for anthrax, bio-toxins, mold, bacteria, VOCs, CO and CO_2, temperature and humidity to help determine cause of worker complaints.

  - Sampled surface and materials for anthrax and bio-toxins at two commercial facilities.

  - Selected and completed analysis to determine cause of illness to players in their locker room at Nationwide Arena for the Columbus Blue Jackets professional hockey team.

  - Served as an expert to the OSFC on building HVAC and human comfort issues in school buildings.

  - Developed implementation templates for several Process Safety Management (PSM) and Risk Management Program (RMP) clients (e.g. Nestle facilities).

  - Prepared public meeting presentation materials for AEP RMPs at their Conesville and Tanners Creek power plants. Focus was to match public legal requirements with needs of the client, and development and presentation of worst case and alternative case release scenarios under Part 68 of 40 CFR.

  - Completed PSM programs for two Southwest Research Institute (SwRI) facilities and two Nestle facilities. Focus was on completing process hazards analyses (PrHAs) and on setting up ongoing PSM programs. For Nestle, set up file-based system, wrote plans for all 14 major elements, and

provided detailed checklists and guidance on sections such as training, mechanical integrity, etc.

- Completed multiple ventilation projects for American Electric Power Plant facilities to determine best locations (performance vs. cost) for hazardous gas monitors in power plants and whether or not ductwork was contaminated with mold.
- Completed series of EH&S projects for Dublin schools (e.g. air quality audits and noise analyses). Completed air clearance testing and reporting and held public meetings for the vandalism clean-up efforts of Grizzell Middle School.
- Conducted industrial hygiene audits and testing for numerous public and private clients. Focused on HVAC systems, sampling (CO, CO_2, relative humidity, molds, dust, bacteria, formaldehyde, VOCs, and isocyanates) and remediation/abatement.
- Completed Failure Modes & Effects Analyses (FMEA) for DOD BZ Nerve Agent Plant design. Plant was later built, operated, and decommissioned in Pine Bluff, AR without incident.

➢ Developed IAQ solutions based on ASHRAE Standards and new technologies (e.g. desiccants).

➢ Developed and taught OSHA HAZWOPPER courses (40-hr, 24-hr and 8-hr).

➢ Voting member ASHRAE TC 8.3; corresponding member ASHRAE TC 3.5 (Desiccants).

➢ Adjunct Professor at Franklin University. Instructor of Environmental and Earth Sciences courses.

Engineering Experience

➢ President and Owner of EES Group, Inc. (EES) since 1996. Developed EES into one of the leading forensic companies in the state of Florida and Ohio.

➢ Author of *Forensic Engineering: Damage Assessments for Residential and Commercial Structures*, January 3, 2013, a CRC Press publication (2nd Edition to issue in early 2022). The book provides guidance on engineering claims assessments for the insurance industry.

➢ Developed forensics libraries and technical bulletins on how to assess insurance claims and fraud associated with claims. Lead author of refereed journal article reviewing hail damage from ~750 individual assessments.

➢ Completed or supervised over 7,000 forensics inspection projects for ~100 insurance companies and other private sector clients since 2002. Projects were associated with structural failures in residential and commercial buildings, structural damage and failures caused by vehicles striking buildings, water causation and origin analysis, causes of plumbing failures, HVAC failures and damage, roof system failures and structural damage, mold cause, origin and removal, lead cause and removal, hail damage, and lightning claims. Also completed or supervised over 200 insurance appraisals (negotiated settlements)

for the industry. Was selected and completed role as an umpire for a 36-building one million dollar hail claim dispute. Testified in trial on roofing claim disputes. Specifically requested for difficult projects and for projects in the state of Texas.

- Led company in efforts to bid and win roofing and environmental contracts with the Ohio School Facilities Commission (OSFC).
- Managed the turnkey design, permitting, and building of a fuel farm facility ($750K) for The Ohio State University (OSU) Airport (2000). Project entailed the layout, design, and installation of six aboveground storage tanks (ASTs), 12,000 gallons each, and the removal and closure of four existing USTs. Fuels included Jet-A and Av-Gas. Project roles included site plans/layouts, preparation of subcontractor specifications, construction oversight, concrete foundation and subsurface design, permitting (PTI and PTO), start-up troubleshooting, and commissioning activities.
- Was lead researcher on two teams of nationally recognized residential and commercial heat pump development programs: i) Battelle (Double-Effect Absorption Heat Pump) and ii) Columbia Gas System (Dual Cycle Heat Pump). Both projects met goals for performance (efficiency and capacity). Research resulted in receipt of six U.S. Patents.
- Co-designed parking lot and storm-water collection system for major trucking firm on 40-acre site in Cleveland. Project began as a site assessment and concluded with facility design.
- Process engineer for 200 million gallons-per-day wastewater treatment plant for a Weyerhaeuser paper mill.
- Evaluated incineration technology and cost/benefit for an incinerator that burned organophosphate and chlorinated thio-ether wastes. Developed source term for present and future emissions under varying load rates.
- Prepared a carbon treatment designs for removing organophosphates and chlorinated thio-ether, and nerve agents from wastewater.
- Designed/permitted first of three mobile wastewater treatment facilities in the State of Ohio.
- Developed a process to eliminate HF/tar hazardous waste generation from an electronics manufacturing process.
- Developed processes to reduce contamination of water from oil spills, including biodegradation and controlled combustion.
- Conducted bench-scale analysis of reverse osmosis, ultrafiltration, wet air oxidation, and solvent extraction treatment processes.

Environmental Experience

- Provided 8-hr. Tier 1 & Tier 2 training to State of Ohio BUSTR site coordinators (May 23, 2000).
- Provided approximately 40 hours of Risk Assessment Training (five 8-hr. training sessions) to BUSTR coordinators (May 1999).
- Member of BUSTR's new rules advisory committee (1999).

- Completed over a dozen BUSTR Tier 2 and Tier 3 Risk Assessments (RA) for clients such as CITGO, AEP, Anderson Concrete, and the Port Columbus Airport Authority. Creative solutions saved years of remediation and millions of dollars.
- Completed BUSTR Tier 4 RA for American Electric Power.
- Completed Environmental Assessment for NASA - Lewis Rocket Engine Test Facility.
- Completed dozens of Federal/State air, water, and hazardous waste permits (e.g., PTI, PTO, FESOP and NPDES) for dozens of industrial clients.
- Developed Spill Prevention, Controls and Countermeasures (SPCC) Plan template according to 40 CFR 112. Developed SPCC template, which has been audited and accepted by Ohio EPA. Prepared site-specific SPCC's for clients such as L.J. Minor (Cleveland), Mickley Oil Company, Doersam LLC, Federal Express Corporation (Blue Ash), and Central Ohio Asphalt.
- Prepared hazardous waste evaluation for the NASA–Merritt Island Environmental Impact Assessment of Space Shuttle SRB refurbishing facility in a wildlife area.
- Developed a portion of the database used in preparing the original Resource Conservation and Recovery Act (RCRA).
- Developed BUSTR Residential and Commercial Risk Assessment (RA) Models.

Other Experience

- Responsible for all intellectual property (e.g., patents) and commercialization of residential, commercial, vehicle, and fuel cell technology for Columbia Gas System and their development partners.
- Served on 11 Industry Advisory Bodies [Gas Research Institute (GRI), American Gas Association (AGA), U.S. Department of Energy Funding Initiative - $2 billion (USDOE-FI), and Gas Utilization Research Forum (GURF)].
- Served as U.S. DOE expert reviewer on cooling, heat pump, desiccant, and power generation proposals.
- Served on U.S. DOE expert review panel for desiccant program area.
- Prepared business acquisition due diligence for Columbia Gas System corporate staff (e.g. micro-turbines).
- Provided technical and business due diligence for three venture capital firms on a dozen emerging markets.
- Authored budget recommendations for DOE Funding Initiative in Power Generation, Cooling, and NGV areas based on industry consensus meetings.
- Served/Serving on ANSI and ASHRAE Standards Working Groups (Z21.40 and SPC 40).
- Provided keynote presentations on Energy Deregulation for four major utilities and several industry groups.
- Completed nationally recognized market research on U.S. cooling, refrigeration, and controls markets.

Certifications, Registrations, and Honors

Registered Professional Engineer, State of Florida #76583, State of Kentucky #24116, State of Ohio #49063, State of Pennsylvania #PE-053899-E, State of Texas #101855 (also listed windstorm inspector), and State of West Virginia #16311

Certified Industrial Hygienist, 8067 CP, November 2000.

Certified Safety Professional, 23563, November 2012

Asbestos Hazard Evaluation Specialist – State of Ohio #ES34643

Certified Residential Mold Inspector – (IESO) - 2004

ASHRAE Certificate of Appreciation, May 2002, ASHRAE Standard 40.

ASHRAE Fundamentals of HVAC Systems – 35 CEUs (Feb. to April 2008).

AIHA CIH Refresher (Univ. of Michigan) – 40-hr. class - 1998

Certificate of Accomplishment in Risk Assessment from The Ohio State University School of Public Health – 120-hr. class – 1997

Certificate of Achievement – Ohio Department of Transportation 80-hr. class – Managing in the Environmental Process – 1997 Roof

Consulting Institute (RCI) Courses:

- Advanced Thermal & Moisture Control (5/14/2008)
- Professional Roof Consulting (5/15-16/2008) Roof Technology & Science I (9/15-16/2009)
- Roof Technology & Science II (9/17-18/2009)

Undergraduate Scholarships from the Pulp and Paper Foundation Scholarship Fund for Freshman, Sophomore, and Junior Years.

Certificate of High Scholarship – Department of Chemical Engineering – University of Washington – Jr. Year - 1978.

Undergraduate Scholarship from Department of Chemical Engineering, Senior Year.

Undergraduate B.S. Ch.E. – Cum Laude.

Graduate School - M. S. Ch. E. – 2nd in Class

Raymond Roesch Award, University of Dayton, (awarded annually to top MBA graduate); graduated first in MBA class with 4.0 GPA – 1988.

Memberships

Member, American Industrial Hygiene Association (AIHA)

Member, American Conference of Governmental Industrial Hygienists (ACGIH)

Member, American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE). Voting Member TC 8.3.

Member, American Institute of Chemical Engineers (AIChE)

Member, Indoor Environmental Standards Organization (IESO)

Member, Roof Consulting Institute (RCI)

Member, Society of Automotive Engineers (SAE)

Member, Sigma Xi

U.S. Patents

U.S. 6,649,062. November 18, 2003. Fluid-Membrane Separation. Petty.

U.S. 6,109,339. August 29, 2000. Heating System. Talbert, Ball, Yates, Petty, and Grimes.

U.S. 5,769,033. June 23, 1998. Hot Water Storage. Petty and Jones.

U.S. 5,636,527. June 10, 1997. Enhanced Fluid-Liquid Contact. Christensen and Petty.

U.S. 5,546,760. August 20, 1996. Generator Package for Absorption Heat Pumps. Cook, Petty, Meacham, Christensen, and McGahey.

U.S. 5,533,362. July 9, 1996. Heat Transfer Apparatus for Heat Pumps. Cook, Petty, Meacham, Christensen, and McGahey.

U.S. 5,339,654. August 23, 1994. Heat Transfer Apparatus for Heat Pumps. Cook, Petty, Meacham, Christensen, and McGahey.

U.S. 5,067,330. November 26, 1991. Heat Transfer Apparatus for Heat Pumps. Cook, Petty, Meacham, Christensen, and McGahey.

U.S. 4,972,679. November 27, 1990. Absorption Refrigeration and Heat Pump System with Defrost. Petty and Cook.

Books

Forensic Engineering: Damage Assessments for Residential and Commercial Structures, January 4, 2013, CRC Press, 804 pp.

Publications

Stephen E. Petty, 2020, *Visible dust and asbestos: what does it suggest regarding asbestos exposures?* Journal of Scientific Practice and Integrity. 2(1). DOI: 10.35122/001c.14496, August.

Stephen E. Petty, Mark Nicas, Anthony A. Boiarski, 2011. *A quantitative Method for Estimating Dermal Benzene Absorption from Benzene-containing Hydrocarbon Liquids*, Int. J Occup Environ Health, Vol. 17/No. 4, Oct./Dec. 2011, pgs. 287-300.

Stephen E. Petty, PE, CIH, Mark Petty, Tim Kasberg, 2009. *Evaluation of Hail-Strike Damage to Asphalt Shingles Based on Hailstone Size, Roof Pitch, Direction of Incoming Storm, and Facing Roof Elevation*, Interface, The Journal of RCI; May/June, Vol. XXVII, No. 5, pgs. 4-10.

Peter F. Infante, MPH, DRPH, Stephen E. Petty, PE, CIH, D. H. Groth, G. Markowitz, D. Rosner, 2009. *Vinyl Chloride Propellant in Hair Spray and Angiosarcoma of the Liver among Hairdressers and Barbers: Case Reports*, Int. J Occup Environ Health; 15:36-42.

Petty, S.E., Ball, D., Nation, J. and S. Talbert, 1997. *A New, Integrated Compact Combo System for Multi-Family Residences*, Proceedings of the 48th Conference Papers Available from the 48th International Appliance Technical Conference (IATC), May 12 - 14, 1997, Ohio State University – Fawcett Center, Columbus, OH.

Petty, S.E., 1997. *Mack's LNG Truck Ready to Move into Refuse Collection Market,* NGV Tech Update, Gas Research Institute, Spring Edition, pgs. 1 and 3.

Petty, S., 1983. *Combustion of Crude Oil on Water*, Fire Safety Journal, Vol. 5, pgs. 123-134.

Petty, S., B.A. Garrett-Price and G.L. McKown, 1983. *Preliminary Assessment of the Use of Heat Transfer Fluids for Solar Thermal Energy Systems*, EPA-600/S7-83-021, U.S. Environmental Protection Agency, April.

English, C.J., S.E. Petty and D.S. Sclarew, 1983. *Treatment of Biomass Gasification Wastewaters Using a Combined Wet Air Oxidation/Activated Sludge Process,* PNL4593, Contract DE-AC06-76RLO-1830, U.S. Department of Energy, February.

Petty, S.E., W. Wakamiya, C.J. English, J.A. Strand and D.D. Mahlum, 1982. *Assessment of Synfuel Spill Cleanup Options,* PNL-4244, UC-11,90i,91, Contract DEAC06-76RLO 1830, U.S. Department of Energy, April.

Wakamiya, W., Petty, S.E., Boiarski, A., Putnam, A., 1982. *Combustion of Oil on Water: An Experimental Program*, U. S. Department of Energy, DOE/NBM/1002, Contract # AC06-76RLO 1830, February.

Petty, S., B.A. Garrett-Price and G.L. McKown, 1982. *Preliminary Assessment of the Use of Heat Transfer Fluids for Solar Thermal Energy Systems*, PNL-4182, IAG No. AD89-F-1-623-0, U.S. Environmental Protection Agency, January.

Petty, S.E., N.E. Bell and C.J. English, Jr., 1981. *Treatment of Biomass Gasification Wastewaters Using Wet Air Oxidation, Solvent Extraction and Reverse Osmosis,* PNL

SA-10093, Proceedings of the 13th Biomass Thermochemical Conversion Contractor's Meeting, Arlington, VA, October 27-29, pgs. 718-747.

Petty, S.E., N.E. Bell and C.J. English, Jr., 1981. *Treatment of Biomass Gasification Wastewaters Using Wet Air Oxidation, Solvent Extraction and Reverse Osmosis,* Contract DE-AC06-76RLO-1830, U.S. Department of Energy, October.

Petty, S.E., S.D. Eliason and M.M. Laegreid, 1981. *Treatment of Biomass Gasification Wastewaters Using Reverse Osmosis,* PNL-4018, Contract DE-AC06-76RLO-1830, U.S. Department of Energy, September.

Mercer, B.W., W. Wakamiya, S.E. Petty, J.A. Strand and D.D. Mahlum, 1981. *Assessment of Synfuel Spill Cleanup Options,* PNL-SA-9806 – Proceedings of DOE
Workshop on Processing, Needs, and Methodology for Wastewater from the Conversion of Coal, Oil Shale and Biomass to Synfuels, Richland, WA.

Eakin, D.E., J.M. Donovan, G.R. Cysewski, S.E. Petty and J.V. Maxham, 1981. *Preliminary Evaluation of Alternative Ethanol/Water Separation Processes,* PNL-3823, UC-98d, Contract DE-AC06-76RLO-1830, U.S. Department of Energy, May.

Zima, G.E., G.H. Lyon, P.G. Doctor, G.R. Hoenes, S.E. Petty and S.A. Weakley, 1981. *Some Aspects of Cost/Benefit Analysis for In-Service Inspection of PWR Steam Generators,* NUREG/CR-1490, PNL-3388, U.S. Nuclear Regulatory Commission, May.

Petty, S.E., 1981. *Potential Synthetic Fuel Spill Sources and Volumes to the Year 2000,* Contract DE-AC06-76RLO 1830, U.S. Department of Energy, March.

Petty, S.E. and W. Wakamiya, 1981. *Projections on Synfuels Production to the Year 2000,* Contract DE-AC06-76RLO 1830, U.S. Department of Energy, January

Petty, S.E., and J.V. Maxham, 1981. *Ethanol-Water Separation Using a Corn as a Dehydration Agent,* Contract DE-AC06-76RLO 1830, U.S. Department of Energy, January.

J.V. Maxham and S.E. Petty, 1980. *Dehydration of Alcohol/Water Solutions with Solid Dehydration Agents to Produce Alcohol for Gasohol,* Contract DE-AC06-76RLO 1830, U.S. Department of Energy, September.

Petty, S.E., and J.V. Maxham, 1980. *Ethanol-Water Separation Using a Reverse Osmosis Process,* PNL-3579, Contract DE-AC06-76RLO 1830, U.S. Department of Energy, September.

English, C.J., S. E. Petty and G.W. Dawson. 1980. *Identification of Hazardous Waste Disposal Sites and Management Practices in Region 10.* Contract WA-79-A375, U.S. Environmental Protection Agency, February.

Dawson, G.W., C.J. English and S.E. Petty, 1980. *Physical Chemical Properties of Hazardous Waste Constituents,* U. S. Environmental Protection Agency, Southeast Environmental Research Laboratory, Athens, Ga. March 5.

Wakamiya, W., J.V. Maxham and S.E. Petty, 1979. *Biomass Gasification Wastewater Treatment – Interim Report,* PNL-SA-8165, Contract EY-76-C-06-1830, U.S. Department of Energy, September.

SUMMARY OF PRESENTATIONS
By
Stephen Petty

DATE	LOCATION	AUDIENCE	TOPIC	DURATI
April 1, 1999	Bureau of Underground Storage Tank Regulators (BUSTR) Reynoldsburg, OH	BUSTR Chief and State Coordinators, Training Session	BUSTR RISK ASSESSMENT TRAINING Introductory Session	8 h
April 22, 1999	Bureau of Underground Storage Tank Regulators (BUSTR) Reynoldsburg, OH	BUSTR Chief and State Coordinators, Training Session	BUSTR RISK ASSESSMENT TRAINING Second Session	8 h
May 6, 1999	Bureau of Underground Storage Tank Regulators (BUSTR) Reynoldsburg, OH	BUSTR Chief and State Coordinators, Training Session	BUSTR RISK ASSESSMENT TRAINING Third Session	8 h
May 27, 1999	Bureau of Underground Storage Tank Regulators (BUSTR) Reynoldsburg, OH	BUSTR Chief and State Coordinators, Training Session	BUSTR RISK ASSESSMENT TRAINING Fourth Session	8 h
June 4, 1999	Bureau of Underground Storage Tank Regulators (BUSTR) Reynoldsburg, OH	BUSTR Chief and State Coordinators, Training Session	BUSTR RISK ASSESSMENT TRAINING Fifth Session	8 h
May 23, 2000	Bureau of Underground Storage Tank Regulators (BUSTR) Reynoldsburg, OH	BUSTR Chief and State Coordinators, Training Session	Factors Influencing Tier 1 and Tier 2 Evaluations Training Session for New Rules	8 h
January 18, 2001	Engineer's Club, Dayton, OH	ASHRAE, Dayton Chapter, Dinner Speaker	Energy and Cost Benefit Analyses of Heating, Ventilation and Air Conditioning Systems Available for Ohio Schools	2 h

DATE	LOCATION	AUDIENCE	TOPIC
January 25, 2001	Riffe Tower, Columbus, OH	Ohio School Facilities Commission, Ohio Department of Development, State School A/Es	Energy and Cost Benefit Analyses of Heating, Ventilation and Air Conditioning Systems Available for Ohio Schools
March 13, 2001	Ashland Chemical, Columbus, OH	PDMA – Columbus Chapter, Breakfast Speaker	The Product Development Process - Case Studies

July 30, 2001	Toledo, OH	City of Toledo, Environmental Director and Staff	Status of BUSTR's New Rule, March 31, 1999
September 21, 2001	Lexington, KY	ASHRAE Region VII & Bluegrass Chapter, Invited Luncheon Speaker	Energy and Cost Benefit Analyses of Heating, Ventilation and Air Conditioning Systems Available for Ohio Schools
November 13, 2001	Wadsworth, OH	ASHRAE Akron Chapter, Dinner Speaker	Energy and Cost Benefit Analyses of Heating, Ventilation and Air Conditioning Systems Available for Ohio Schools
February 12, 2002	Cincinnati, OH	ASHRAE Cincinnati Chapter, Lunch Speaker	Evaluation of Heating, Ventilation and Air Conditioning Systems (HVAC) Systems Availab for Ohio Schools
July 2002	Cleveland, OH	AIHA Luncheon Speaker	IAQ Cost – Benefit Analyses For Heating, Ventilation and Air Conditioning Systems (HVAC) Systems Available for Ohio Schools
September 24, 2002	Columbus, OH	Ohio Builds 2002	Evaluation of HVAC Systems Contained in the OSFC Design Manual
February 5, 2003	Toledo, OH	ASHRAE Toledo Chapter, Dinner Speaker	Energy and Cost Benefit Analyses of Heating, Ventilation and Air Conditioning Systems Available for Ohio Schools
May 9, 2004	Atlanta, GA	American Industrial Hygiene Conference and Expo (AIHce), Professional Development Course #418	Mold Contamination: A Hands-On Workshop Addressing Inspection, Remediation Specifications, Project Oversight and Post-Remediation Assessment
September 14, 2004	Gahanna, OH	Gahanna Board of Realtors Luncheon Speaker	Mold – After the Contract

DATE	LOCATION	AUDIENCE	TOPIC
November 4, 2004	Cincinnati, OH	Cincinnati Bar Association Luncheon Speaker	Mold – Facts/Fiction/Who Knows?
November 17, 2004	Columbus, OH	Ohio Public Facility Maintenance Association (OPFMA) Annual Meeting	Impact of Temperature on Occupants: Theory v Reality
October 17, 2005	Phoenix, AZ	LexisNexis Benzene Litigation Conference	How Low Can You Go? Measuring Exposure t Benzene
April 21, 2006	Cleveland, OH	National Business Institute Proving Damages Caused by Mold Infestation in Ohio	Make a Mold Claim and Litigate the Case
November 9, 2006	Columbus, OH	Bricker & Eckler Building Industry	Avoiding and Handling Mold Claims

June 3, 2008	New Orleans, LA	Harris-Martin Benzene Conference	Historic Levels of Benzene in Products
August 14, 2009	Columbus, OH	State Auto Insurance Company	Assessment of Hail and Wind Damage
December 4, 2009	Akron, OH	Nationwide Insurance Company	Presentation and Seminar on Log Cabin Construction, Maintenance & Reparability
March 17, 2010	Westerville, OH	Nationwide Insurance Company	Seminar on Impact of Wind & Hail Damage to Building Materials
May 9, 2012	Dublin, OH	Grange Insurance Company	Lightning Damage Assessments
June 18, 2013	Delaware, OH	Nationwide Insurance Company	Forensic Analysis of Fire Damage to Foundation Walls

SUMMARY OF CLASSES TAUGHT AT FRANKLIN UNIVERSITY By Stephen Petty

Class Title	Description	Term	Dates	# Students	Comments
SCIE131 Q1WW	Environmental Science 131	Winter 2003	1/3/03 to 4/24/03	17	Online class
SCIE131 E1FF	Environmental Science 131	Summer 2003	5/21/03 to 6/25/03	13	In-Class
SCIE114 F2FF	Earth Science 114	Fall 2003	9/29/03 to 11/3/03	17	In-Class
SCIE131 H1FF	Environmental Science 131	Fall 2003	11/12/03 to 12/17/03	15	In-Class
SCIE131 Q1WW	Environmental Science 131	Summer 2004	05/17/04 to 08/07/04	14	Online class
SCIE131 H1FF	Environmental Science 131	Fall 2004	11/10/04 to 12/15/04	19	In-Class
SCIE 131 H1FF	Environmental Science 131	Fall 2005	11/9/05 to 12/14/05	19	In-Class
SCIE 131 H1FF	Environmental Science 131	Spring 2006	3/27/06 to 5/1/06	?	In-Class

SCIE 114 – 4 Semester Credit Hours
SCIE 131 – 4 Semester Credit Hours

EXHIBIT ii

SUMMARY OF EXPERT WITNESS CASES – STEPHEN PETTY

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
Mr. Luther L. Liggett Jr. Bricker & Eckler, L.L.P. 100 S. Third Street Columbus, OH 43215	Construction Corporation vs. Roth Produce (Supported Plaintiff). Testified at hearing in Franklin County, OH.	Refrigerated Warehouse (Design Purpose – HVAC) Testified at Mediation Hearing	Settled in Arbitration	- / -	2001
Mr. Michael P. Giertz Hartley & O'Brien, P.L.L.C. The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff(s): Sandra D. Howell and Estate of Mr. Howell Defendant(s): Nalco, Bayer and David Hackathorn (Bayer's Director of Health) In the Circuit Court of Marshall County, West Virginia (Supported Plaintiffs)	Legionella Exposure at Chemical Plant Deposed by Defendant(s) 2003	Negotiated Settlement	EES-2002-002 Case No. 00-C-234M	2002
Mr. R. Dean Hartley Hartley & O'Brien, P.L.L.C. The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff(s): Donna E. Gwinn, Individually and Executrix of the Estate of William B. Gwinn Defendant(s): Chemical Leaman Tank Lines (CLTL), a Delaware Corporation, Quality Distribution, Inc., d/b/a Quality Carrier, Successor-in-Interest to Chemical Leaman Tank Lines, Inc., a Florida Corporation, and Okey Edens. In the Circuit Court of Marshall County, West Virginia. (Supported Plaintiffs).	Benzene Exposure at Tanker Truck Cleaning Facility Deposed on 3/21/2003	Negotiated Settlement	EES-2002-040 Case No. 02-C-120M	2002-2003
Mr. Guy Bucci Attorney at Law Bucci, Bailey & Javins P. O. Box 3712 Charleston, West Virginia 25337	Plaintiff(s): William Shaffer and Rosa Shaffer, husband and wife. Defendant(s): Monongahela Power Company d/b/a Allegheny Power as an Ohio Corporation In the Circuit Court of Pleasants County, West Virginia (Supported Plaintiff)	Legionella Exposure at Power Plant Settled 04/2004	Negotiated Settlement	EES-2002-01 Cause No.: 00 -C-28	2001 - 2004
Mr. James M. Barber Attorney at Law 604 Virginia Street, East Suite 200 Charleston, WV 25301	Plaintiff(s): Daniel O. Dixon Defendant(s): A C & S, Inc. (Supported Plaintiff)	Acid Gas Exposure at Chemical Plant Settled 05/2004	Negotiated Settlement	EES-2003-005 Cause No.: 02-C-1995	2003 - 2004
Mr. R. Dean Hartley Hartley & O'Brien, P.L.L.C. The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff(s): Michael A. Lebron, Pamela Lebron Defendant(s): Shell Oil Company; Amoco Oil Company; Union Oil Company of California; Radiator Specialty Company; PPG Industries, Inc.; E.I. Du Pont de Nemours & Company and Bondo Corporation. (Supported Plaintiffs)	Benzene Exposure from Paint and Service Station Operations Deposed by Defendant(s) on 11/21/03	Negotiated Settlement 03/2009	EES-2002-052 Cause No.: 01L10021	2002-2009

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
Mr. Brian Bradigan Attorney At Law Brian J. Bradigan, L.L.C. 3948 Townsfair Way Suite 230 Columbus, OH 43219	Plaintiff(s): Jeffrey and Theresa Vaughn (Homeowners) Defendant(s): Timberline Log Homes (Grange Insurance – Builder's Insurance) (Supported Defendant)	Mold and Water Leaks in Log Home Due to Poor Construction	Negotiated Settlement	EES-2003-019 -	2003
Ms. Joanne Peters Attorney At Law Isaac, Brant, Ledman & Teetor LLP 250 E. Broad St. Suite 900 Columbus, OH 43215-3742	Plaintiff(s): Fisher (Homeowners) Defendant(s): Muth and Company – Roofing Company (Supported Defendant)	Mold and Water Leaks in Home Due to Roof Installation	Negotiated Settlement	- / -	2003
Mr. R. Dean Hartley Hartley & O'Brien, P.L.L.C. The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff(s): Timothy J. Farley Defendant(s): Keystone Shipping Company, Margate Shipping Company and Chilbar Shipping Company Shipping Company Court of Common Pleas Philadelphia County, PA Civil Action - Law (Supported Plaintiff)	Benzene and other Chemical Exposures from Working on Tankers	Negotiated Settlement 8/09/2004	EES-2003-180 Cause No.: 0957	2003-2004
Mr. R. Dean Hartley Hartley & O'Brien, P.L.L.C. The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff(s): David Ball Defendant(s): BASF, Corp., Ford Motor Company, 3M Company, Petroleum Traders Company, Myers Industries, Inc., d/b/a Patch Rubber Co., Radiator Specialty Company, Loctite Corporation, and Lykins Oil Company Court of Common Pleas Cuyahoga, Ohio (Supported Plaintiff)	Benzene and other Chemical Exposures Focus on Labeling and MSDS sheets	Negotiated Settlement 12/2005	EES-2003-217 Cause No.: CV-02-473352	2003-2005
Voltolini & Voltolini Attorneys at Law 1350 West Fifth Ave. Suite 214 Columbus, OH 43212	Plaintiff: Janis Weekly Defendant(s): Terminix Pre-Lawsuit (Supported Plaintiff)	Durisban - Chlorpyrifos (Pesticide) Exposure Completed detailed inspection and research.	Completed	EES-2003-352 Cause No: 94-018	2003-2004

Harvit & Schwartz, L.C. 2018 Kanawha Blvd., E. Charleston, WV 25311	Plaintiff: Robert H. Casdorph, Jr and Melba Casdorph, his wife Defendant(s): West Virginia State Police, an agency of the State of West Virginia, and Castle Products, Inc., a New York Corporation. In the Circuit Court of Marshall County, West Virginia (Supported Plaintiff)	CML-Chronic Myelogenous Leukemia	Negotiated Settlement 11/2011	EES-2003-329 Cause No.: 03-C-109M Worker's Comp. Decision Appealed to WV Supreme Ct. – Decision in	2003-2011

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
				Favor of Plaintiff on 11/9/2019	
Dinsmore & Shohl, LLP 255 E. Fifth Street, Suite 1900 Cincinnati, OH 45202	Plaintiff: Doug Kinslow Defendant(s): M.E.B. Two (Supported Defendant)	Mold Contamination Inspection, mold testing and detailed findings report	Negotiated Settlement	EES-2003-353 Cause No.: 3780-88	2003-2004
Mr. Scott Sheets Attorney At Law Isaac, Brant, Ledman & Teetor LLP 250 E. Broad St., Suite 900 Columbus, OH 43215-3742	Plaintiff: Stanger (Homeowners) Defendant(s): Davis Fine Homes – Homebuilder (Supported Plaintiff)	Mold and Water Inspection, Testing, and Support	Negotiated Settlement	EES-2003-366	2003
Mr. J. Andrew Crawford Reese, Pyle, Drake & Meyer, P.L.L. 36 N. Second Street P.O. Box 919 Newark, OH 43058-0919	Plaintiff: Murray Headlee et al. Defendant(s): Truberry Group, Inc. et al. (Homebuilder) Delaware, OH County Court of Common Pleas (Supported Defendant)	Mold and Water Leaks in Home; Prepared outline of opinions.	Negotiated Settlement on/about 03/08/2004	EES-2003-405 Cause No.: 03 CVH 01007	2003 - 2004
Mr. J. Zackary Zatezalo Hartley & O'Brien, P.L.L.C. The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff: Mr. James V. Dollhopf and Kristin L. Dollhopf Defendant(s): PPG Industries, Sherwin-Williams Company, Ashland, Inc., CIBA Specialty Chemicals, Chem-Pak Solutions, General Fiberglass Supply, Inc., Meguiar's Products, Sunnyside Corporation, Milwaukee Paint, Inc. State of Wisconsin Circuit Court Milwaukee County (Supported Plaintiff)	Benzene and other Chemical Exposures from Painting Operations	Negotiated Settlement	EES-2003-407 Cause No.: 03-CV-4832	2003-2004

Mr. R. Dean Hartley Hartley & O'Brien, P.L.L.C. The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff: Shelly Gray, Individually and as Plaintiff Ad Litem for Sherri Bond, deceased. Defendant(s): BP Corporation North America Inc. and BP Products North America Inc. et.al – Former American Oil Company (AMOCO) Site Circuit Court of Jackson County, Missouri, at Independence. (Supported Plaintiff)	Benzene and other Chemical Exposures from Underground Piping and Tank Leaks	Negotiated Settlement 03/16/2006	EES-2003-415 Case No.: 02-CV-229538	2003-2006
Mr. J. Michael Prascik Hartley & O'Brien, P.L.L.C. The Wagner Building 2001 Main Street, Suite 600, Wheeling, WV 26003	Plaintiff: Mr. Barry Hovis and Lesa Hovis, his wife. Defendant(s): Carboline Company, Rust-Oleum Corporation, E.I. Dupont De Nemours and Company, Valspar Coatings, One Shot, LLC, PPG Industries, Inc., Sherwin-Williams, . In the Circuit Court of Common Pleas in York County, South Carolina. (Supported Plaintiff)	Exposure to Paint	Negotiated Settlement 10/2004	EES-2004-049 Cause No.: 2003-CP-46-165	2004
Mr. J. Michael Prascik Hartley & O'Brien, P.L.L.C. The Wagner Building	Plaintiff: Lucinda Cutlip Defendant(s): West Virginia Department of Transportation, Division of Highways, and Guttman Oil Company, a foreign	Exposure to Diesel Exhaust	Testified in Trial 1/10/06	EES-2004-066	2004-2006

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
2001 Main Street, Suite 600, Wheeling, WV 26003	corporation In the Circuit Court of Kanawha County West Virginia (Supported Plaintiff)	Deposed by Defendant(s) on 08/11/2005 and 09/21/2005	Decision in Favor of Defendant	Cause No.: 02-C-2345	
Mr. Kris Cormany Attorney at Law Bucci, Bailey & Javins P. O. Box 3712 Charleston, West Virginia 25337	Plaintiff: Erby E. Lester and Donna Lester, his wife Defendant(s): Elk Run Coal Company, Inc. a West Virginia Corporation d/b/a Black Castle Mining Company, Spartan Mining Company, a West Virginia Corporation and d/b/a Trace Transport Company. In the Circuit Court of Boone County West Virginia. (Supported Plaintiff)	Exposure to Combustion Products From Fire in Maintenance Building Deposed by Defendant on 03/01/2006	Negotiated Settlement 05/10/2006	LAW-2004-009 Cause No.: 04-C-231	2004 - 2006
Mr. Guy R. Bucci Bucci Bailey & Javins Suite 910 Bank One Center, 707 Virginia Street, East, Charleston, WV 25301	Plaintiff: Linda Kitzmiller Defendant(s): Jefferson Supply Co. United States District Court For the Northern District of West Virginia, Elkins Division (Supported Plaintiff)	Exposure to Chemicals Deposed by Defendant(s) 06/06/2006 Daubert Hearing 10/30/2006 – Motion Denied	Negotiated Settlement 11/05/2007	LAW-2004-010 Cause No.: 2:05-CV-22	2004 - 2007

Mr. Chris Wilson Wilson, Frame, Benninger & Metheney, P.L.L.C.	Plaintiff: Paula J. Ondo Defendant(s): TBD (Supported Plaintiff)	Mold and HVAC	Completed Report Submitted	EES-2004-134	2004
Mr. J. Michael Prascik Hartley & O'Brien, P.L.L.C. The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff: Mr. Douglas Bates Defendant(s): The Dow Chemical Company et al. (Supported Plaintiff)	Chemical Exposure - Various products in garage	Closed	EES-2004-137 Cause No.: 3:03CV519BN	2005-2009
Mr. J. Michael Prascik Hartley & O'Brien, P.L.L.C. The Wagner Building 2001 Main Street, Suite 600, Wheeling, WV 26003	Plaintiff: Deborah Trojan Defendant(s): Peoples Gas Light & Coke Co. (Supported Plaintiff)	Benzene Exposure From Former Manufactured Gas Plant Site Deposed by Defendant 11/12/2004	Negotiated Settlement 12/2004	EES-2004-135 Cause No.: 01 L 16472	2004

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
Charles Cooper Charles Cooper Law Offices 407 Center Street Ironton, OH 45638	Plaintiff: Mr. and Mrs. Shelton Defendant(s): Mr. and Mrs. LeMaster (Supported Plaintiff) In response to Grange Claim #: HP91871 (Supported Defendant)	Mold and Water Damage	Closed	LAW-2004-004	2004-2005
Mr. R. Dean Hartley Hartley & O'Brien, P.L.L.C. The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff: Mr. Robert Scherer Defendant(s): S & S Automotive, Inc. et al. (Supported Plaintiff)	Benzene Exposure Deposed by Defendant(s) 11/11/2004	Negotiated Settlement 11/2005	LAW-2004-001 Cause No.: 02 L 435	2004-2005
Mr. R. Dean Hartley Hartley & O'Brien, P.L.L.C. The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff: Mr. Earl Douglas Defendant(s): Ashland, Inc. et al. (Supported Plaintiff)	Benzene Exposure Deposed by Defendant(s) 03/29/2005 Daubert Hearing 01/13/2006 – Motion Denied	Negotiated Settlement 04/2008	LAW-2004-002 Cause No.: 01/CE-00392	2004-2008

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
Mr. Guy R. Bucci Bucci Bailey & Javins Suite 910 Bank One Center, 707 Virginia Street, East, Charleston, WV 25301	Plaintiff: Brummage et al. Defendant(s): Thrasher et al. (Supported Plaintiff)	Mold and Bacteria Exposures/Sewage System Failure (Two expert reports written late 2004 and early 2005).	Negotiated Settlement 09/2005	LAW-2004-003	2004-2005
Mr. William M. Owens Owens & Manning 413 Main Street, 2nd Floor Coshocton, OH 43812	Plaintiff: Ms. Delaine Freeman Defendant(s): Randy Stotts et al. (Supported Plaintiff)	Mold Determination	Negotiated Settlement 10/2004	LAW-2004-005 Cause No.: 02 CI 588	2004
Mr. R. Dean Hartley Hartley & O'Brien, P.L.L.C. The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff: Mr. Terry Defendant(s): Go-Mart Inc. et al. (Supported Plaintiff)	Benzene Exposure Deposed by Defendant(s) 8/20/2009	Negotiated Settlement 9/2010	LAW-2004-006	2004-2010
Mr. David J. Romano Romano Law Office 363 Washington Avenue Clarksburg, WV 26301	Plaintiff; Cathy A. Arnett Representative of John P. Arnett (Deceased) Defendant(s); The Marmon Corporation et al. (Supported Plaintiff)	Hazardous Chemical Exposure – Cleaners with Sodium Hydroxide	Negotiated Settlement 02/14/2005	LAW-2004-007 Cause No.: 03-C-570-2	2004 - 2005
Mr. Stephen Brown Mundy & Nelson, L.L.C. P.O. Box 2986 Huntington, WV 25728	Plaintiffs: TBD – Citizens of Huntington Defendant: TechSol (Supported Plaintiff)	Hazardous Chemical Exposure – Coal Tar Containing Benzene – Sampled Creek and Homes for VOCs	Negotiated Settlement 11/2006	LAW-2004-011	2004 - 2005
Mr. Paul Eklund Davis & Young 1700 Midland Building 101 Prospect Avenue West Cleveland, OH 44115-1027	Plaintiffs: Enrico M. Clark and Cynthia Clark Defendant(s): Alchem Corporation and B. George Bufkin (Supported Defendant)	Hazardous Chemical Exposure – Methanol and Acid Gases	Negotiated Settlement 07/2006	LAW-2004-014 Cause No.: 528128	2004 - 2006
Mr. Brian Bradigan Attorney At Law Brian J. Bradigan, L.L.C. 3948 Townsfair Way, Suite 230 Columbus, OH 43219	Plaintiffs: Wanner Searls (Homeowner) Defendant(s): Grange Mutual Casualty Company Franklin County Ohio Court of Common Pleas (Supported Defendant)	Hail Damage to Home	Testified in Trial 04/18/2005 Decision in Favor of Defendant(s) 05/31/2005	EES-2004-094	2004 - 2005

Mr. Lon Walters Partner The Walters Law Firm The Oldham Building 105 East 5th Street Suite 401 Kansas City, MO 64106	Plaintiff: Estate of Nancy Ryan Defendant(s): BP Corporation, American Oil Company, et al. Circuit Court of Jackson County, Independence, MO (Supported Plaintiff)	Benzene/Chemical Exposures from Underground Piping and Tank Leaks and Vapor Emissions	Testified in Trial 08/24-25/2005 Jury Ruled in Favor of Plaintiff(s) – 09/14/2005	LAW-2004-012 Cause No.: 04CV223271	2004 - 2005
Mr. John Davis Gallagher, Sharp, Fulton & Norman 1501 Euclid Avenue, Seventh Floor Cleveland, OH 44115 Mr. Charles Williams 555 South Front Street, Suite 320 Columbus, OH 43215	Plaintiff: Hidden Lakes Condominium Association Defendant: Acuity Insurance Company (Umpire – Supported Defendant)	Hail Damage Appraisal Umpire Claim #: KL3009 Umpired Decision and Report Issued 04/2005	Completed	EES-2005-020S	2005
Mr. Nicholas Subashi Subashi, Wildermuth & Ballato The Oakwood Building 2305 Far Hills Avenue Dayton, OH 45419 Mr. Randall Saunders Nationwide Insurance Company 620 Morrison Road Gahanna, OH 43230	Plaintiff: James Wilson et al. Defendant: STO Corp., Jack H. Wieland Builders, DaytcoJames, Inc. et al. (Supported Defendant – Roofing Contractor)	Construction Defect Claims Claim #: 92 34 AC 324909 03011997 51 Provided Inspection, Analysis and 3 reports on liability of roofing contractor.	Completed Negotiated Settlement 06/30/2005	EES-2005-050-S Cause No.: 03 CV 61596	2005

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
Mr. James M. Barber Attorney at Law 604 Virginia Street, East Suite 200 Charleston, WV 25301	Plaintiff: Lola Hudson Defendant: Arbors Management and Rock Branch Mechanical (Supported Plaintiff)	Legionella Exposure Deposed 12/13/2005	Closed	Law-2005-001	2005 - 2006
Mr. J. Zachary Zatezalo Hartley & O'Brien, P.L.L.C. The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff: Little Defendant: American Electric Power (Supported Plaintiff)	Solvent Exposure Deposed by Defendant 03/25/2011	Negotiated Settlement 2011	LAW-2005-002 Cause No.: 03-C-256M	2005-2011
Mr. Guy R. Bucci Bucci Bailey & Javins Suite 910 Bank One Center, 707 Virginia Street, East, Charleston, WV 25301	Plaintiff: Mr. Daniel A. Wilson and Mrs. Joyce L. Wilson Defendant: Mr. Raymond Johnson d/b/a Ray's Auto Center (Supported Plaintiff)	Hazardous Chemicals Exposure	Closed	LAW-2005-006 Cause No.: 04-C-232	2005-2007

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
Mr. Michael P. Giertz Hartley & O'Brien, P.L.L.C. The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff: Janice Weekley Defendant: Terminix International Company (Supported Plaintiff)	Property Contamination from Termidicides (Pesticides) Deposed by Defendant 09/09/2005	Negotiated Settlement 11/2005	LAW-2005-007 Cause No.: 52-181-0069704	2005
Mr. Bradley R. Oldaker Bailey, Stultz, Oldaker & Greene P.O. Drawer 1310 Weston, WV 26452-1310	Plaintiff: Mack O. Crist Defendant: Vicellio & Grogan et al. (Supported Plaintiff)	Silica- Exposure – Highway Construction Deposed by Defendant 01/17/2006	Negotiated Settlement 05/2006	LAW-2005-008 Cause No.: 04C-64M	2005-2006
Mr. J. Zachary Zatezalo Hartley & O'Brien, P.L.L.C. The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff: Jayne Chianelli and estate of Frank Chianelli Defendant(s): Shell Oil Company, Potter Paint Co., Mohawk Finishing Products, Phipps Products Corp., BIX Manufacturing Company, Sherwin Williams Company, Barnett Industries and E.E. Zimmerman (Supported Plaintiff)	Solvent Exposure	Negotiated Settlement 2006	LAW-2005-009 Cause No.: 03 12999/	2005-2006
Mr. R. Dean Hartley Hartley & O'Brien, P.L.L.C. The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff: Denny Morris Defendant: PPG Industries, Inc. (Supported Plaintiff)	Benzene Exposure Deposed by Defendant 10/12/2005	Closed	LAW-2005-010 Cause No.: 99-C-173M	2005-2009
Mr. R. Dean Hartley Hartley & O'Brien, P.L.L.C. The Wagner Building Suite 600 2001 Main Street, Wheeling, WV 26003	Plaintiff: Thomas H. Ware and Pamela S. Ware, his wife Defendant: Pratt & Whitney Engine Services, Inc. In the Circuit Court of Harrison County, West Virginia (Supported Plaintiff)	Hazardous Chemicals Exposure	Negotiated Settlement 01/2006	LAW-2005-011 Cause No.: 05-C-139-1	2005-2006
Ms. Sandra Spurgeon Spurgeon & Tinker, PSC 120 Prosperous Place, Suite 202 Lexington, KY 40509	Robert A. Tompkins, et al v. Wheeling-Pittsburgh Steel Corporation d/b/a Wheeling Corrugating Company, Inc., et. al v. Terry Roland (Supported Defendant - Insurance Company)	Exposure	Closed	LAW-2005-013	2005-2008

Mr. Louis H. Watson, Jr., P.A. Attorney at Law 520 Capitol Street Jackson, Mississippi 39201-2703	Plaintiff: Fay Lundy and Joel Lundy Defendant: Cilburn Truck Lines, Inc., Conoco, Inc., Individually, a/k/a Conoco Gas and Marketing, a Division of Conoco, Inc., and f/k/a Du Pont Holdings, Inc; ConcoPhillips Company; "John Doe" Defendant(s) In the United States District Court for the Southern District of Mississippi Jackson Division (Supported Plaintiff)	Exposure to benzene from gasoline Deposed by Defendant 9/20/2006	Negotiated Settlement	LAW-2005-014 2005-16 Case No. 200516	2005-2007
Mr. Michael P. Giertz Hartley & O'Brien, P.L.L.C. The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff: Pauline Poling Defendant: Grafton Auto Parts Circuit Court of Marshall County, West Virginia (Supported Plaintiff)	Exposure to Benzene Containing Solvents	Negotiated Settlement	LAW-2005-016 Case #: 05-C157M	2005-2009
Mr. Thomas E. Schwartz Holloran White & Schwartz LLP 2000 S. 8th Street St. Louis, Missouri 63104	Plaintiff: Jeff Morgan Defendant: National Railroad Passenger Corporation (Supported Plaintiff)	Diesel Exhaust Exposure Deposed by Defendant 01/31/2006	Negotiated Settlement 04/28/2006	LAW-2005-018 Cause No.: 052-08718	2005-2006
Mr. Richard A. LaVerdiere Sieben Polk LaVerdiere & Dusich 999 Westview Drive Hastings, MN 55033-2495	Plaintiff: Vettrus Defendant: Ashland Chemical et al. Third Judicial District Court, County of Rice, MN (Supported Plaintiff)	Exposure to solvents containing benzene Deposed by Defendant(s) 03/20/2007	Closed	LAW-2005-019 C5-05-1909	2005-2008
Mr. Kevin George 931 Vauxhill Lane Powell, OH 43065	Plaintiff: Mallory Pools Defendant: Mr. Kevin George Delaware County, Ohio Court of Common Pleas (Supported Defendant)	Pool chemistry and staining on Liner. Testified in Trial (Delaware County Court) 01/19/2006	Decision in favor of Defendant	EES-2006-166	2005-2006
Ms. Denyse Clancy Baron & Budd, P.C. 3102 Oak Lawn Ave., Suite 1100	Plaintiff: Benoit Defendant: Ato Fina et al.	Exposure to benzene and benzene containing solvents in	Closed	LAW-2005-020	2005-2007

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
Dallas, TX 75219	18th Judicial District Court, For the Parish of Iberville, State of Louisiana (Supported Plaintiff)	refineries and chemical plants		Cause No.: 62116, Div. A	

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
Ms. Denyse Clancy Baron & Budd, P.C. 3102 Oak Lawn Ave., Suite 1100 Dallas, TX 75219	Plaintiffs: Stubbs & Wilkinson (two cases). Ms. Ann Stubbs, representing the estate of Ben L. Stubbs Herbert W. Wilkinson and Peggy S. Hebert Defendant(s): Radiator Specialty Company et al. 128th Judicial District Court, Orange County, TX (Supported Plaintiff)	Exposure to benzene & benzene-containing solvents- refineries, chemical plants Deposed by Defendant(s) 3/29/06 and 4/25/06	Negotiated Settlement	LAW-2005-021 & BAR-2006-001 Stubbs/Wilkinson - Cause No.:A-030272C	2005-2007
Mr. Thomas E. Schwartz Holloran White & Schwartz LLP 2000 S. 8th Street St. Louis, Missouri 63104	Plaintiff: Ursula Michelle Creaghan and Daniel Aaron Creaghan as surviving children of Steven Francis Creaghan Defendant: Superior Solvents & Chemicals, Inc.; Transchemical Inc., Ashland, Inc., Chemisphere Corp., Reichhold, Inc. Akzo Nobel Coatings, Inc., Brenntag MidSouth, Inc., Eastman Chemical Co., and Shell Oil Company (Supported Plaintiff)	Benzene exposure from paint manufacturing Deposed by Defendant on 8/29/2006	Negotiated Settlement 9/2006	LAW-2005-022 Cause No.: 042-07417	2005-2007
Mr. Lon Walters The Walters Law Firm The Oldham Building 105 East 5th Street, Suite 401 Kansas City, MO 64106	Plaintiff: Detel Defendant: BP Corporation North America, Inc., and BP Products North America, Inc. Circuit Court of Jackson County, Independence, MO (Supported Plaintiff)	Benzene exposure Deposed by Defendant on 9/11/2006	Negotiated Settlement 10/18/2006	WAL-06-001 Cause No.: 04CV207637	2005-2006
Mr. R. Dean Hartley Hartley & O'Brien, P.L.L.C. The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff: Richard C. Smith and Vickie Smith Defendant(s): Sal Chemical Company, Inc., Chemical Solvents, Inc., and United States Can Company Circuit Court of Brooke County, WV (Supported Plaintiff)	Organic Chemical Exposure Deposed by Defendant(s) 02/06/2007	Negotiated Settlement 06/2007	HAR-2006-002 Case No.: 05-C-211 AMR	2006-2007
Ms. Denyse Clancy Baron & Budd, P.C. 3102 Oak Lawn Ave., Suite 1100 Dallas, TX 75219	Plaintiffs: Troy Lucas Defendant(s): Diamond Shamrock, Marathon, U.S. Steel, WD-40, Radiator Specialty, ConocoPhillips and Occidental Chemical 23rd Judicial District Court, Brazoria County, TX (Supported Plaintiff)	Exposure to benzene and benzene containing solvents while working for Diamond Shamrock	Closed	BAR-2006-002 Cause No. 35,311	2006-2007
Ms. Denyse Clancy Baron & Budd, P.C. 3102 Oak Lawn Ave., Suite 1100 Dallas, TX 75219	Plaintiffs: Donna Cashiola, Page Defendant(s): American Petroleum Institute, Inc. et al. 298th Judicial Court, Dallas, TX (Supported Plaintiff)	Exposure Deposed by Defendant 9/22/2006	Decision in favor of Defendant	BAR-2006-005 Cause No.: 04-00545	2006-2008

Ms. Denyse Clancy Baron & Budd, P.C. 3102 Oak Lawn Ave., Suite 1100 Dallas, TX 75219	Plaintiff: David Carpenter Defendant(s): Spray Products Corp. et al. Circuit Court of Cook County, Chicago, Illinois (Supported Plaintiff)	Benzene Exposure	2007	BAR-2006-006 Cause No.: 2006L00673	2006-2007
Ms. Denyse Clancy Baron & Budd, P.C. 3102 Oak Lawn Ave., Suite 1100 Dallas, TX 75219	Plaintiffs: Larry Koger (deceased) and Kim Koger Defendant(s): Ashburn Industries et al. 128th Judicial District Court, Orange County, TX (Supported Plaintiff)	Exposure to benzene and benzene containing solvents while working for EBBA Iron	Negotiated Settlement	BAR-2006-007 Cause No.: A050388-C	2006-2007
Mr. Kirk Claunch Baron & Budd, P.C. 3102 Oak Lawn Ave., Suite 1100 Dallas, TX 75219	Plaintiffs: Bekkelund Defendant(s): General Tire, Shell, Specialty Radiator 23rd Judicial District Court, Brazoria County, TX (Supported Plaintiff)	Exposure to benzene and benzene containing solvents Deposed by Defendant 3/13/2007	Negotiated Settlement	BAR-2006-009 Cause No.: 24038*BJ03	2006-2008
Mr. Andrew DuPont Locks Law Firm 1500 Walnut Street, 20th Floor Philadelphia, PA 19102	Plaintiff: Kirk Jenkins Defendant(s): (Supported Plaintiff)	Benzene Exposure	Negotiated Settlement 2008	LOC-2006-001	2006-2008
Mr. Bradley Oldaker Bailey, Stultz, Oldaker & Green P.O. Drawer 1310 Weston, West Virginia 26452	Plaintiffs: William K. Stern et al. Defendant(s): Chemtal Incorporated et al. Circuit Court of Marshall County, West Virginia (Supported Plaintiff)	Exposure to Polyacrylamide Flocculant with Residual Acrylamide Monomer.	Negotiated Settlement	OLD-2007-001 Cause No.: 03C-49M	2004
Mr. Lon Walters The Walters Law Firm The Oldham Building 105 East 5th Street, Suite 401 Kansas City, MO 64106	Plaintiff: Sean Reed Defendant(s): B.P. Corporation North America, Inc., and BP Products North America, Inc. et al. Circuit Court of Jackson County, Missouri at Independence (Supported Plaintiff)	Benzene Exposure	Negotiated Settlement	WAL-2007-001 Cause No.: 04CV-209341	2007
Mr. John Hughes The Law Offices of John J. Hughes 1200 Gough Street, Suite 1 San Francisco, CA 94109	Plaintiff: Daniel F. Dean as administrator of the estate of William J. Dean Defendant(s): Overseas Shipbuilding Group (OSG) Ship Management, Inc., Juneau Tanker Group, Inc., Cambridge Tankers, Inc., OMI Corp., Interocean Ugland Management, Inc., and SL Service, Inc. Superior Court of the State of California, County of San Francisco (Supported Plaintiff)	Benzene Exposure	Negotiated Settlement 04/2008	HUG-2007-001 Cause No.: CGC-04-430986	2007-2008
Mr. Jim Waldenberger Kline & Specter The Nineteenth Floor	Plaintiff: Karen Horvat, Estate of Andrew J. Horvat, Deceased, et al.	Benzene Exposure	Negotiated Settlement	WAL-2007-001	2007-2012

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
1525 Locust Street Philadelphia, PN 19102	Defendant(s): Crane Oil Company et al. Superior Court of New Jersey Gloucester County (Supported Plaintiff)		01/2012	Cause No.: GLO-000497-07	
Mr. J. Keith Hyde Ms. D'Juana Parks Provost & Umphrey, L.L.P. 490 Park Street P.O. Box 4905 Beaumont, TX 77704	Plaintiff: Jan Goss, Individually and as Representative of the Estate of Velma Church, Deceased, et al. Defendant: Schering-Plough Corp. 4th Judicial Court, Rusk County, State of Texas (Supported Plaintiff)	Benzene Exposure	Negotiated Settlement 04/2008	PAR-2007-001 Cause No.: 2006-232	2007-2008
Bradley R. Oldaker Bailey, Stultz, Oldaker & Greene P.O. Drawer 1310 Weston, West Virginia 26452	Plaintiff: Estate of Darren Patrick Brake Defendant: TKS Contracting Circuit Court of Upshur County, West Virginia (Supported Plaintiff)	Wrongful Death Forklift Accident	Negotiated Settlement 02/2008	OLD-2007-002 Case No.: 07-C-155	2007-2008
Mr. John Langdoc Baron & Bud Baron & Budd, P.C. 3102 Oak Lawn Ave., Suite 1100 Dallas, TX 75219	Plaintiff: Edward Paul Wick Defendant(s): 3M Company et al. Court of Common Pleas Philadelphia County (Supported Plaintiff)	Asbestos	Negotiated Settlement 02/2009	BAR-2007-004 Cause No.: 0512-2989	2007-2009
Mr. Lon Walters The Walters Law Firm The Oldham Building 105 East 5th Street, Suite 401 Kansas City, MO 64106	Plaintiff: Paul Hedrick & Joyce Hedrick Defendant: BP Corporation North America Inc. and BP Products North America Inc. – Former American Oil Company (AMOCO) Site Circuit Court of Jackson County, Missouri at Independence (Supported Plaintiff)	Benzene Exposure	Negotiated Settlement	LON-2007-002 Cause No.: 04CV-209360 – Div. 16	2007
Mr. Lon Walters The Walters Law Firm The Oldham Building 105 East 5th Street, Suite 401 Kansas City, MO 64106	Plaintiff: Barbara Behymer, individually and as Plaintiff Ad Litem for Richard Behymer, deceased Defendant: BP Corporation North America Inc. and BP Products North America Inc. – Former American Oil Company (AMOCO) Site. Circuit Court of Jackson County, Missouri at Independence. (Supported Plaintiff)	Benzene Exposure	Negotiated Settlement 03/07/2008	LON-2007-003 Cause No.: 04CV238342	2007-2008
Mr. Chuck Gordon Hubbell Peak O'Neal Napier & Leach Law Firm Union Station 30 W. Pershing Rd., Suite 350 Kansas City, MO 64108	Plaintiff: Robert L. Almaguer Defendant: The Burlington Northern & Santa Fe Railway Company City Court of the City of St. Louis, State of Missouri (Supported Plaintiff)	Railroad Worker PAH Exposure	Negotiated Settlement 08/16/2008	HUB-2007-001 Cause No.: 052-10081	2007-2008
Mr. Gregory A. Lofstead Richardson, Patrick, Westbrook & Brickman, LLC 174 East Bay Street Charleston, 29401	Plaintiff: Dennie Polk Defendant: Brooks Run Coal Company et al. Circuit Court of Mingo County, West Virginia (Supported Plaintiff)	Silicosis	Negotiated Settlement 01/2008	RPWB-2007-001 Cause No.: 04-C-650	2007-2008

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
Mr. Gregory A. Lofstead Richardson, Patrick, Westbrook & Brickman, LLC 174 East Bay Street Charleston SC 29401	Plaintiff: Ricky G. Prince and Diana Prince Defendant: Eastern Associated Coal Corp. et al. Circuit Court of Mingo County, West Virginia (Supported Plaintiff)	Silicosis	Negotiated Settlement 05/2008	RPWB-2007-002 Cause No.: 04C-289	2007-2008
Mr. James Zury The Law Offices of James C. Zury 450 Alkyre Run Drive, Suite 120 Westerville, OH 43082	Defendant: Ohio Builders, Inc. and Mr. David B. Holbert, President Plaintiff: Rick and Karen Upchurch (Supported Defendant)	Mold Contamination	Negotiated Settlement 01/2008	SUR-07-001	2007-2008
Mr. Thomas E. Schwartz Holloran White & Schwartz LLP 2000 S. 8th Street St. Louis, Missouri 63104	Plaintiff: Paula Dangerfield Defendant: BP Corp. North America, Inc. et al. Third Judicial Circuit Court, Madison County, State of Illinois (Supported Plaintiff)	Benzene Exposure	Negotiated Settlement 2014	SCH-07-001 Case #: 08-L-1032	2007-2014
Mr. James Billings Zacks Law Firm 33 S. James Road Columbus, OH 43213	Plaintiff: Joseph Pingue Defendant: Able Roofing Franklin County, Ohio Court of Common Pleas (Supported Plaintiff)	Roofing/Water Infiltration Testified in Trial 6/9/2008	Decision in Favor of Plaintiff	ZAC-08-001	2008
Mr. Thomas E. Schwartz Holloran White & Schwartz LLP 2000 S. 8th Street St. Louis, Missouri 63104	Plaintiff: Tricia Mary Iraci and the Estate of Giacomo Iraci Defendant(s): Heritage-Crystal Clean, LLC, Superior Solvents & Chemicals, Inc., Citgo Petroleum Corporation, Sunoco, Inc., The Valvoline Company and 3M Company Circuit Court of Cook County Illinois County Department, Law Division (Supporting Plaintiff)	Benzene Exposure Deposed by Defendant(s) 5/04/2011	-	SCH-2008-001 Case No.: 05 L 7528	2008
Mr. Thomas E. Schwartz Holloran White & Schwartz LLP 2000 S. 8th Street St. Louis, Missouri 63104	Plaintiff: Tomas Fields Defendant: The Alton & Southern Railway Company Circuit Court – St. Clair County, IL (Supported Plaintiff)	Railroad Diesel and Benzene Exposure Deposed by Defendant(s) 3/16/2010	Negotiated Settlement 8/2010	SCH-2008-003 Cause: 06L 308	2008-2010
Mr. R. Dean Hartley Hartley & O'Brien, P.L.L.C. The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff: Elmer B. Haymond and Norma Haymond Defendant(s): Moore North American, Inc. et al. Circuit Court of Marshall County, WV (Supported Plaintiff)	Organic Chemical Exposure	Negotiated Settlement	HAR-2008-001 Cause No.: 04-C-211	2008

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
Mr. R. Dean Hartley Hartley & O'Brien, P.L.L.C. The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff: Daniel E. Emery and Liselle Emery Defendant(s): Shell Oil Company, Individually and d/b/a Shell Chemical Company and as Successor-by-Merger to Pennzoil-Quaker State Company, a Delaware Corporation, Pennzoil-Quaker State Company, C. E Bradley Laboratories, Inc., Exxon Mobil Corporation, Safety-Kleen Systems, Inc., f/k/a Safety-Kleen Corp., The Coleman Company, Inc., Cleveland Lithochrome, Company, Inc., Minnesota Mining and Manufacturing Company (3-M), Miles Supply Company, Inc., Granite City Tool Company of Vermont, Inc., Intertape Polymer Corp. State of Vermont, Washington County, SS (Supporting Plaintiffs)	Benzene Exposure Deposed by Defendant(s) 7/21/2010	Negotiated Settlement	HAR-2008-002 Cause No. 80-2-09 WNCV	2008
Mr. Karl Novak Richardson, Patrick, Westbrook & Brickman, LLC 174 East Bay Street Charleston SC 29401	Plaintiff(s): Debra Herzog, Individually and as Administrator of the Estate of Kent Herzog, Deceased, for the use and benefit of Surviving Next of Kin, Debra Herzog (Surviving Spouse), Ryan Herzog, and Heather Ragan (Surviving Children) Defendant(s): Tex-Trim, Inc.; Sunnyside Corp.; E.I. DuPont De Nemours and Company; Superglue Corp.; The Savogran Company; RPM Wood Finishes Group; Inc., Wilsonart International, Inc., WD-40 Company, W.M. Barr & Co., Inc., DAP, Inc.; Mohawk Finishing Products, Inc.; The Glidden Co., D/B/A ICI Paints; OSI Sealants, Inc.; Do it Best Corp.; Henkel Consumer Adhesives; Inc., Henkel Corp., Individually and as successor to Henkel Locktite Corp.; Sovereign Specialty Chemicals; Henkel Consumer Adhesives, Inc., OSI Sealants, Inc., and Formica Corp.; IPS Corp. (formally Industrial Polychemical Service); Franklin International, Inc. (formerly Franklin Glue); Camie-Campbell, Inc. (formerly Camie Co.); and Camie-Campbell International, Inc. Circuit Court of the Third Judicial Circuit, Madison County, Illinois (Supported Plaintiffs)	Benzene Exposure	Negotiated Settlement 02/2010	RPWB-2008001 Cause No.: 207-L-538	2008-2010
Mr. Robert Black Heard, Robins, Cloud & Lubel, LLP 3800 Buffalo Speedway, 5th Floor Houston, Texas 77098	Plaintiff(s): Walter Mairose, Individually and as Executor of the Estate of Mae I. Mairose et al. Defendant(s): The Dow Chemical Company et al. Circuit Court for Baltimore City, County of Baltimore, State of Maryland (Supported Plaintiff)	Vinyl Chloride Exposure	Negotiated Settlement 08/2008	HRCL-2008-001 Case No.: 24-C-06-011110	2008
Mr. Keith Patton Shrader & Associates	Plaintiff(s): John Davis Ward, et al. Defendant(s): Citizens Gas & Coke Utility	Benzene Exposure	Negotiated Settlement	SCHM-08-001 Cause No.:	2008

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
3900 Essex Lane, Suite 390 Houston, TX 77027	Marion County Superior Court, State of Indiana (Supported Plaintiffs)		05/2008	49D03-0701CT-002020	
Mr. Gene Egdorf The Lanier Law Firm 6810 FM - 1960 West Houston, Texas 77069	Plaintiff(s): Judy A. Bates, individually and as Personal Representative of the Heirs and Estate of Loren G. Bates, Deceased, et al. Defendant(s): Shintech, Inc. et al. United States District Court for the Western District of Missouri (Supported Plaintiff)	Vinyl Chloride Exposure	Negotiated Settlement 2008	LAN-08-001 Cause No.: 060944-CV-WGAF	2008-2008
Mr. Zach Zatezalo Bordas & Bordas, PLLC 1358 National Road Wheeling, West Virginia 26003	Plaintiff(s): Mr. Joe Berry Charlton, Vicki Charlton (wife), and Shasta Charlton (daughter) Defendant: Wheeling-Pittsburgh Steel Corp. West Virginia Worker's Compensation Office of Judges & Brooke County Circuit Court (Supported Plaintiffs)	Coke Oven Gases and Heat Exposure Deposed by Defendant 05/10/2011	Negotiated Settlement 2012	BOR-08-003 Claim #: 2006204793 Cause No.: 07-C-119	2008-2012
Mr. Andrew J. DuPont Locks Law Firm The Curtis Center 601 Walnut Street, Suite 720 East 170 South Independence Mall West Philadelphia, Pennsylvania 19106	Plaintiff(s): Michael Cardello and Tracy Cardello, his wife Defendant: CRC Industries, Inc. et al. Court of Common Pleas of Allegheny County, State of Pennsylvania (Supporting Plaintiffs)	Benzene Exposure	-	LOC-08-001 Cause No. GD-05-029307	2008
Mr. Robert Black Heard, Robins, Cloud & Lubel, LLP 3800 Buffalo Speedway, 5th Floor Houston, Texas 77098	Plaintiff(s): Robert B. Oakley (Deceased) and Irene Oakley Defendant(s): Air Products and Chemicals, Inc., Aristech Chemical Corporation; Atlantic Richfield Company, BP Corporation of America, Inc., BP Products North America , Inc., BP Amoco Chemical Company, Occidental Chemical Corporation, Radiator Specialty Company, United States Steel Corporation, and USX Corporation U.S. District Court for the Eastern District of Texas Marshall Division (Supported Plaintiff)	Benzene Exposure 11/25/2008 - Defendant(s) motion to exclude Petty testimony denied.	Negotiated Settlement 12/2008	HRCL-08-002 Case No.: 2:07-CV-00351	2008
Mr. Robert Black Heard, Robins, Cloud & Lubel, LLP 3800 Buffalo Speedway, 5th Floor Houston, Texas 77098	Plaintiff(s): Gerald Diaz (deceased) and Deborah Diaz Defendant(s): Handschy Industries, Inc., E.I. DuPont de Nemours & Co., et al. In the District Court, Orange County, 128th Judicial District Court (Supported Plaintiff)	Benzene Exposure	Negotiated Settlement 8/2012	HRCL-08-003 Cause No.: A-070037DC	2008-2012

Mr. R. Dean Hartley Hartley & O'Brien, P.L.L.C. The Wagner Building	Plaintiff(s): Mr. Richard Gordon Defendant(s): Texaco Marine Services, Inc. et al.	Benzene Exposure	Negotiated Settlement 08/2011	HAR-08-005	2008-2011

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
2001 Main Street, Suite 600 Wheeling, WV 26003	United States District Court for the District of New Jersey (Supported Plaintiff)	Deposed by Defendant(s) 6/28/2011		Cause No. 09 CV-911 (JAG)	
Mr. Keith Patton Shrader & Associates 3900 Essex Lane, Suite 390 Houston, TX 77027	Plaintiff(s): Mr. Raul Zendejas and Araceli Zendejas. Defendant(s): Shell Oil Company, Shell Chemical, LP, Individually and as Successor-in-interest to Shell Chemical Corporation, ConocoPhillips Company, Von Verde Citrus Packing House, Inc., an Arizona corporation; Von Verde Harvesting, Inc., a dissolved Arizona corporation; and Von Verde Citrus Growers Cooperative, Inc a dissolved Arizona Corporation In the Superior Court of the State of Arizona in and for the County of Maricopa (Supported Plaintiffs)	Benzene Exposure Deposed by Defendant(s) 9/23/2009 Trial Testimony 11/910/2009	Decision in Favor of Defendant(s) 11/19/2009	SCHM-08-002 Cause No.: CV-2007-005399	2008-2009
Mr. R. Dean Hartley Hartley & O'Brien, P.L.L.C. The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff(s): Bonnie L. Mallory, Executrix of the Estate of Robert E. Mallory, Deceased Defendant(s): Goodyear Tire & Rubber Company, Akron, OH, et al. Court of Common Pleas, Summit County, Ohio (Supported Plaintiff)	Benzene Exposure Deposed by Defendant(s) 10/21/2009	Negotiated Settlement 2010	HAR-08-006 2007-11-8033 Case No.: CV07-11-8033	2008-2010
Mr. Raphael Metzger Metzger Law Group 401 E. Ocean Blvd., Suite 800 Long Beach, CA 90802	Plaintiff(s): Thomas Wayne Reese Defendant: Gans Ink & Supply Co., and Does 1 through 200, inclusive Superior Court of the State of California for the County of Los Angeles – Central District (Supported Plaintiff)	Benzene Exposure Deposed by Defendant 7/7/2009	Negotiated Settlement 05/2010	MET-08-001 Case No.: BC332936	2008-2010
Mr. Guy Bucci Bucci, Bailey & Javins 213 Hale Street Charleston, WV 25301	Plaintiff(s): Michael Schmidt Defendant: Bayer Corporation, Bayer Material Science LLC, John Cool, Terry Eddy, Charles "Buddy" Kotson and John Long Circuit Court of Marshall County, West Virginia 7/28/2008 2nd Amended Complaint Filed (Supported Plaintiff)	TDI Exposure Deposed by Defendant 02/03/2010 and 06/03/2010	Negotiated Settlement 09/2012	BUC-07-001 Case No.: 08-C-121-K	2007-2012

Mr. Thomas E. Schwartz Holloran White & Schwartz LLP 2000 S. 8th Street St. Louis, Missouri 63104	Plaintiff(s): Suzanne Schaefer, Individually and as Special Administrator of the Estate of Richard D. Schaefer, Deceased Defendant: The Premcor Refining Group, Inc. formerly known as Clark Refining & Marketing, Inc. and formerly known as Clark Oil & Refining Corporation, and Illinois Petroleum Company, Inc. and Texor Petroleum Company,	Benzene Exposure	-	SCH-08-005 Case No.: 06 L 578	2008

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
	Inc., and Parent Petroleum, Inc. Circuit Court of Will County, State of Illinois (Supporting Plaintiff)				
Ms. Kelly McMeekin Paul & Hanley 1608 Fourth Street, Suite 300 Berkeley, CA 94710	Plaintiff(s): Julie (Judy) Murray, Individually and as Successor-In-Interest to Erica Murray Defendant: Chevron Corporation; Union Oil Company of California; Greka Oil & Gas, Inc.; Drilling & Production Co.; ConocoPhillips, Kerr-McGee Corporation; Anadarko Petroleum Corporation, Key Energy Group, Inc. and DOES 2-210 Superior Court of the State of California, County of Los Angeles (Supported Plaintiff)	Benzene Exposure Deposed by Defendant(s) 10/2829/2009	Closed 2010	PAU-08-001 Case No.: YCO56221	2008-2010
Mr. Michael P. Giertz Hartley & O'Brien, PLLC The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff(s): Douglas E. Fedor Defendant: Norfolk Southern Railway Co. (Supported Plaintiff)	Benzene Exposure	Negotiated Settlement 11/2008	HAR-08-007 Case No.: CV-08-652069	2008
Mr. Robert Black Heard, Robins, Cloud & Lubel, LLP 3800 Buffalo Speedway, 5th Floor Houston, Texas 77098	Plaintiff(s): Candis L. Snyder, individually, and as the Personal Representative of the Estate of William Luther Clark, Deceased; Patricia L. Clark, Shelley K. Winfrey and Kerry A. Clark, Individually and as the Wrongful Death Beneficiaries of the Estate of William Luther Clark, Deceased Defendant: E.I. DuPont De Nemours and Company, Inc., PPG Industries, Inc., Sherwin Williams Company, BASF Corp., Wesco Group, Inc. U.S. Steel/Aristech Chemical Corp., Radiator Specialty Company, Sunoco, Inc., The Glidden Company and ICI Americas, Inc. Superior Court of the State of Washington in and for the County of King (Supported Plaintiffs)	Benzene Exposure	Negotiated Settlement 7/2010	HRCL-08-004 Case No.: 07-2-27647-5SEA	2008

Mr. R. Dean Hartley Hartley & O'Brien, P.L.L.C. The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff(s): Christopher R. Scearce and Angela W. Scearce, his wife Defendant(s): The Sherwin-Williams Company; Abercrombie Oil Company, Inc.; Hutchens Petroleum Corporation; UNIVAR USA, Inc.; Caswell Auto Parts, LLC; Texaco, Inc.; Chemtek, Incorporated, Travelers Insurance Company and Key Risk Management Services. North Carolina Industrial Commission, Raleigh, North Carolina; State of North Carolina In the General Court of Justice Superior Court, Division, Caswell County (Supporting Plaintiff)	Benzene Exposure Deposed by Defense 10/28/2010 Testified before the North Carolina Industrial Commission 8/11/10	Negotiated Settlement	HAR-08-004 Cause No.: 08-CVS-420	2008

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
Mr. Keith Patton Shrader & Associates 3900 Essex Lane, Suite 390 Houston, TX 77027	Plaintiff(s): George Oliver Tanner, Individually and as Independent Administrator of the Estate of Jimmie Wayne Tanner, Deceased Defendant: ExxonMobil Corporation et al. In the United States District Court for the Southern District of Texas Houston Division (Supporting Plaintiff)	Benzene Exposure	-	SHR-09-001 Cause No.: 01-16849-001	2009
Mr. Guy Bucci Bucci, Bailey & Javins 213 Hale Street Charleston, WV 25301	Plaintiff(s): Ricky J. Carman Defendant: Bayer Corporation, Bayer Material Science LLC, John Cool, Terry Eddy, Charles "Buddy" Kotson and John Long Circuit Court of Marshall County, West Virginia (Supported Plaintiff)	TDI Exposure Deposed by Defendant(s) 02/03/2010	Negotiated Settlement 08/2010	BUC-09-001 Case No.: 08-C269K	2009-2010
Ms. Denyse Clancy Baron & Budd, P.C. 3102 Oak Lawn Ave., Suite 1100 Dallas, TX 75219	Plaintiff(s): Michael Malcontento Defendant: Court of Common Pleas, Philadelphia County, November Term, 2006, No: 0632 (Supported Plaintiff)	Asbestos Exposure	Negotiated Settlement 2010	BAR-009-002 Case No.: 26035 Asbestos	2009-2010
Mr. Keith Patton Shrader & Associates 3900 Essex Lane, Suite 390 Houston, TX 77027	Plaintiff(s): Ms. Barbara Way and Estate of Mr. James Way Defendant: Ashland, Inc., Exxon Mobil Corporation, Shell Oil Company, Chevron U.S.A., Inc., Goodrich Corporation, and Parker Hannifan Corporation In the Court of Common Pleas, Cuyahoga County, Ohio (Supported Plaintiff)	Benzene Exposure	Negotiated Settlement 2010	SHR-09-002 Cause No.: CV 09 683084	2009-2010

Mr. Robert Black Heard, Robins, Cloud & Lubel, LLP 3800 Buffalo Speedway, 5th Floor Houston, Texas 77098	Plaintiff(s): Lewis E. Knapper and Linda Knapper Defendant: Safety-Kleen Systems, Inc., Aristech Chemical Corp., Radiator Specialty Company, Sunoco, Inc. (R&M), United States Steel Corporation, and USX Corporation. U.S. District Court for the Eastern District of Texas Lufkin Division (Supported Plaintiffs)	Benzene Exposure Deposed by Defendant 07/16/2009 11/16/2009 - Defendant(s) motion to exclude Petty testimony denied.	Negotiated Settlement 02/2010	HRCL-09-001 Civil Action No: 9:08-cv-0084	2009-2010
Mr. Robert Black Heard, Robins, Cloud & Lubel, LLP 3800 Buffalo Speedway, 5th Floor Houston, Texas 77098	Plaintiff(s): Linda Denise Smith and Estate of Wesley Fred Smith, Deceased et al. Defendant: E.I DuPont De Nemours and Company, Inc., PPG Industries Inc., Sherwin Williams Company, BASF Corporation, Akzo Nobel Coatings, Inc. United States District Court for the Eastern District of Texas,	Benzene Exposure	Negotiated Settlement 6/2010	HRCL-09-002 Cause No.: 08-CV-385	2009-2010

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
	Beaumont Division (Supported Plaintiff)				
Mr. Robert Black Heard, Robins, Cloud & Lubel, LLP 3800 Buffalo Speedway, 5th Floor Houston, Texas 77098	Plaintiff(s): Fred Cantu and Ruth Cantu Defendant: BP Amoco Chemical Company et al. In the District Court of Galveston Texas, 56th Judicial District (Supported Plaintiffs)	Benzene Exposure	Dismissed 2010	HRCL-09-003 Cause No.: 07 CV 0594	2009-2010
Mr. Robert Black Heard, Robins, Cloud & Lubel, LLP 3800 Buffalo Speedway, 5th Floor Houston, Texas 77098	Plaintiff(s): Darla J. Lemaire, Individually, and as the Independent Executrix of the Estate of Michael Lemaire, Deceased et al. Defendant: Berryman Products, Inc.; Delaware USS Corporation, Huntsman Petrochemical Corporation, Radiator Specialty Company, Texaco Chemical Company, Texaco, Inc., United States Steel Corporation, and USX Corporation 172nd Judicial District of Jefferson County, Texas (Supported Plaintiff)	Benzene Exposure Deposed by Defendant(s) 10/13/2009	Negotiated Settlement 10/31/2009	HRCL-09-007 Cause No.: E-178,440	2009
Mr. Andrew DuPont Locks Law Firm 1500 Walnut Street, 20th Floor Philadelphia, PA 19102	Plaintiff(s): Ryan Glenn Davis and Evan Scott H. Davis, Executors of the Last Will and Testament of Ronald Davis, Deceased. Defendant(s): Sunoco, Inc. (R&M) f/k/a Sun Company, Inc., Radiator Specialty Company, United States Steel Corp., Insilco Technologies, Inc., Eastman Kodak Co., The SherwinWilliams Co., et al. Court of Common Pleas, Philadelphia County (Supported Plaintiffs)	Benzene Exposure	Negotiated Settlement 2011	LOC-2009-002 Cause No.: 090301835	2009-2011

Mr. Andrew DuPont Locks Law Firm The Curtis Center 601 Walnut Street, Suite 720 East Philadelphia, Pennsylvania 19106	Plaintiff(s): Richard Ascani Defendant: E.I. Du Pont Nemours & Company, BASF Corp, SM Co., Safety-Kleen Systems, Inc., et al. Supreme Court of the State of New York, County of Kings (Supported Plaintiff)	Benzene Exposure	Negotiated Settlement 2010	LOC-09-003 Cause No.: 12061-09	2009-2010
Mr. Andrew DuPont Locks Law Firm The Curtis Center 601 Walnut Street, Suite 720 East Philadelphia, Pennsylvania 19106	Plaintiff(s): Joann Grandpre, Individually and as the Administratrix of the Estate of Anthony Grandpre, Deceased; Treva Cadres, Trina Kohlman and Troylise Grandpre, Individually and as the Beneficiaries of the Estate of Anthony Grandpre, Deceased Defendant: PPG Industries, Inc., PPG Industries Ohio, Inc., PPG Coatings, Inc., E.I. DuPont de Nemours & Co., DuPont Performance Coatings, Inc. Individually and as Successor-In-Interest to Spies Hecker, Inc., DuPont Automotive Products, Inc., Spies Hecker, Inc., BASF Corporation, BASF Coatings AG, Individually and Successor-In-Interest to Inmont Corporation, BASF-Inmont Corporation, BASF Corporation-	Benzene Exposure	Negotiated Settlement 2010	LOC-09-004 Cause No. 2004-4180, Division J, Section 13	2009-2010

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
	Inmont Division, The Sherwin-Williams Company, Inc., Sherwin-Williams Automotive Finishes Corp., Illinois Tool Works, Inc. Individually and Successor-In-Interest to Fibre Glass-Evercoat Company, Inc., Crescent City Color, Tarride Color Service, Inc., Tarride Sale, Inc., Automotive Paint & Trimming Supply Company, Inc., Linda's Hip Hop Auto Paint & Supply Shop, LLC. Civil District Court for the Parish of New Orleans, State of Louisiana (Supported Plaintiff)				
Ms. Denyse Clancy Baron & Budd, P.C. 3102 Oak Lawn Ave., Suite 1100 Dallas, TX 75219	Plaintiff(s): Dolores Juliano, as Executrix of the Estate of John Juliano Defendant: A.W. Chesterton Company, et al. In the Court of Common Pleas Philadelphia County, PA. (Supported Plaintiff)	Asbestos Exposure	Negotiated Settlement 2012	BAR-09-003 Cause No.: 001905	2009-2012
Ms. Denyse Clancy Baron & Budd, P.C. 3102 Oak Lawn Ave., Suite 1100 Dallas, TX 75219	Plaintiff(s): Leroy Thompson Defendant: A.W. Chesterton Company, et al. In the Court of Common Pleas Philadelphia County, PA. (Supported Plaintiff)	Asbestos Exposure	Negotiated Settlement 2009	BAR-09-004	2009

Mr. Robert Black Heard, Robins, Cloud & Lubel, LLP 3800 Buffalo Speedway, 5th Floor Houston, Texas 77098	Plaintiff(s): Susan Stevenson, Jordan W. Stevenson and Amy S. Fontenot, Individually, and as Heirs to the Estate of James Edward Stevenson Defendant: Bayer Corporation, Successor in Interest to Miles, Inc., Denka Chemical, Mobay Corporation and Mobay Chemical Company; Atofina Petrochemicals, Inc. individually and formerly known as American Petrofina Company of Texas and Fina Oil and Chemical Company; Chevron Chemical Company; Chevron U.S.A. Incorporated, individually and as successor in interest to Gulf Oil Corporation; Chevron Phillips Chemical Company, LLC; Chevron Phillips Chemical Company LP; Conoco, Inc., individually a/k/a Conoco Gas and Marketing, a Division of Conoco, Inc., and formerly known as Du Pont holdings, Inc.; ConocoPhillips Company; E.I. DuPont de Nemours and Company, Inc.; ExxonMobil Oil Corporation, individually, f/k/a Mobil Oil Corporation, and a/k/a Mobil Chemical Company, a Division of ExxonMobil Oil Corporation; Fina Oil and Chemicals; Fina, Inc.; Goodyear Tire & Rubber Company; Great Lakes Carbon Corporation; Mobil Chemical Company, Inc., individually and f/k/a Mobil Chemical Corporation; Radiator Specialty Company; United States Steel Corporation, individually, f/k/a United States Steel LLC, and	Benzene Exposure	Negotiated Settlement 02/2010	HRCL-09-008 Case No.: A-040211-C	2009

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
	f/k/a USX Corporation; and USX Corporation, individually, f/k/a U.S. Steel Company, f/k/a United States Steel Corporation and as a subsidiary of Marathon Oil Company 128th Judicial District Court, Orange County, Texas (Supported Plaintiffs)				
Ms. Denyse Clancy Baron & Budd, P.C. 3102 Oak Lawn Ave., Suite 1100 Dallas, TX 75219	Plaintiff(s): Stephen J. Kolar and Carol Kolar Defendant: Buffalo Pumps, Inc. et al. Philadelphia County Court of Common Pleas Civil Trial Division (Supported Plaintiffs)	Asbestos Exposure	Negotiated Settlement 2010	BAR-09-005 Case No.: 000199 Asbestos	2009-2010
Ms. Denyse Clancy Baron & Budd, P.C. 3102 Oak Lawn Ave., Suite 1100 Dallas, TX 75219	Plaintiff(s): Earl J. Goodhart and Betty R. Goodhart h/w Defendant: Garlock Sealing Technologies, et al. In the Court of Common Pleas Philadelphia County, PA (Supported Plaintiffs)	Asbestos Exposure	Negotiated Settlement 03/2010	BAR-2009-006 Case No.: 0000436 Asbestos	2009-2010

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
Mr. R. Dean Hartley Hartley & O'Brien, P.L.L.C. The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff(s): John M. Ashworth and Johnnie M. Hord, Individually and Executrix of the Estate of Anthony T. Hord, deceased Defendant(s): The Goodyear Tire & Rubber Company et al. Court of Common Pleas, Summit County, Ohio (Supported Plaintiff)	Benzene Exposure	Negotiated Settlement May 2010	HAR-09-001 Case No.: 2008-10-7361	2009-2010
Mr. R. Dean Hartley Hartley & O'Brien, P.L.L.C. The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff(s)s: Johnnie M. Hord, Individually and Executrix of the Estate of Anthony T. Hord, deceased and John M. Hord Defendant(s): The Goodyear Tire & Rubber Company et al. Court of Common Pleas, Summit County, Ohio (Supported Plaintiff)	Benzene Exposure Deposed by Defendant(s) 07/07/2010	Negotiated Settlement 12/2010	HAR-09-001 Case No.: 2008-10-7361	2009-2010
Mr. Ted Gianaris Simmons Attorneys At Law 707 Berkshire Blvd. P.O. Box 521 East Alton, IL 62024	Plaintiff(s)s: Tristan Tolloty, a minor, by his next friends and parents, Brian Tolloty and Jessica Tolloty Defendant(s): Republic Services, Inc. Republic Services of Ohio, II, LLC, Waste Management, Inc., and Waste Management of Ohio, Inc. In the Court of Common Please, Stark County, Ohio (Supported Plaintiffs)	Benzene Exposure	Resolved 7/2012	SIM-09-001 Case No.: BC 416990	2009-2012
Mr. Andrew DuPont Locks Law Firm 1500 Walnut Street, 20th Floor Philadelphia, PA 19102	Plaintiff(s): Kenneth Roberts and Helen Jean Roberts, his wife. Defendant: Sunoco, Inc. (R&M) f/k/a Sun Company, Inc. and f/k/a Sun Oil Company, Inc., etc. Court of Common Pleas, Philadelphia County (Supported Plaintiffs)	Benzene Exposure	Negotiated Settlement 3/2012	LOC-09-005 Case No.: 3320	2009-2012
Mr. Greg Lofstead Richardson, Patrick, Westbrook & Brickman, LLC 1017 Chuck Dawley Blvd. Mt. Pleasant, SC 29464 & Mr. Timothy C. Bailey Bucci Bailey & Javins LC PO Box 3712 Charleston, WV 25337	Plaintiff(s): Clarence J. Dorsey and Susan Dorsey Defendant: Copperas Coal Corporation; Hunter Ridge Coal Company, f/k/a Anker Energy Corporation; Brooks Run Mining Company, LLC; Fossil Fuels, Inc.; and Kingston Mining, Inc. Circuit Court of Nicholas County, West Virginia (Supported Plaintiffs)	Silica Dust Exposure Deposed by Defendant(s) 09/10/2010	Negotiated Settlement 9/10/2010	RPWB-10-001 Case No.: 09C-36	2010-2010

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
Mr. Raphael Metzger Metzger Law Group 401 E. Ocean Blvd., Suite 800 Long Beach, CA 90802	Plaintiff(s): Laura Hammond, individually and as Guardian ad Litem of Minors Rachel Hammond and John Hammond; Craig Hammond; Elizabeth Wust; Marissa Stockreef; Stephanie Head, and Geoffrey Head Defendant: Chevron Corporation; Chevron USA, Inc.; Angeles Chemical Co., Inc.; Ashland Inc.; Ashland Oil, Inc.; Bortz Oil Co., Inc.; Chemcentral Corp; The Dow Chemical Company; E.I. Du Pont de Nemours and Company; Shell Oil Company; SOCO West Inc.: Union Carbide Corporation and Univar USA Inc. Superior Court of the State of California for the County of Los Angeles – Central District (Supported Plaintiffs)	Benzene Exposure Deposed by Defendant(s) 5/27/2010 Testified in Trial 01/26/2011	Decision in Favor of Defendant 2/2011	MET-10-001 Case No.: BC 358265	2010-2011
Mr. Robert Black Heard Robins Cloud & Black 9 Greenway Plaza, Suite 2300 Houston, Texas 77046	Plaintiff(s): Patricia A. McClurg, Individually and as the Representative of the Estate of Duard Wayne McClurg, Deceased and Terena McClurg Defendant(s): Ingram Barge Company, Savogran Company, W.M. Barr Company, Inc., et al. United States District Court, Eastern District of Texas, Beaumont Division (Supported Plaintiffs)	Benzene Exposure	Negotiated Settlement 11/2010	HRCB-10-002 Case No.: 1:09-CV-00504	2010
Mr. Andrew DuPont Locks Law Firm 1500 Walnut Street, 20th Floor Philadelphia, PA 19102	Plaintiff(s): John J. Mull, III, and Renee Crimmins, H/W Defendant: The Sherwin Williams Company; M.A. Bruder & Sons, Inc.; Urbanik Paint & Wallpaper Co., Inc.; Tnemec, Inc.; Benjamin Moore & Co. Duron Paints & Wallcoverings; Texaco, Inc.; ChevronTexaco Corp.; Getty Petroleum Marketing, Inc. f/k/a Getty Realty Corp. f/k/a Power Test Corp.; Lukoil Americas Corp; Mikecon Corp.; Exxon Mobil Corp; Getty Realty Corp. and John Doe Corporations One through Ten (1-10) Superior Court of New Jersey, Law Division – Camden County (Supported Plaintiffs)	Benzene Exposure Deposed by Defendant(s) 03/17/2011	Negotiated Settlement 5/17/2011	LOC-10-001 Case No.: CAM-L-884-07	2010-2011

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
Mr. Keith Patton Shrader & Associates, L.L.P. 3900 Essex Lane, Suite 390 Houston, TX 77027	Plaintiff(s): Sharon Claytor, Personal Representative of the Estate of Rick D. Lewis; and Hilarie Lewis, Heir of Rick D. Lewis Defendant: Rebel Oil Company, a Nevada Corporation; Kinder Morgan Energy Partners, L.P.; ConocoPhillips Company; Shell Chemical Company; Chevron U.S.A., Inc.; Tosco Corporation; Tosco Refining Company; BP Products North America, Inc. and Atlantic Richfield Company District Court, Clark County, Nevada (Supported Plaintiffs)	Benzene Exposure	Testified in Trial 09/27-28/2011 Decision in Favor of Plaintiff 10/2011 Decision Confirmed by the Supreme Court of Nevada 12/16/2014	SHR-10-001 Case No.: A566869, Dept. XVII	2010-2011
Mr. Darren Brown Provost Umphrey Law Firm, LLP 490 Park Street Beaumont, Texas 77701	Plaintiff(s): Monte McWilliams Defendant(s): Exxon Mobil Corporation et al. 14th Judicial District Court, Parish of Calcasieu, State of Louisiana, Division E (Supported Plaintiff)	Benzene Exposure	Decision in Favor of Plaintiff 02/2012	PRO-10-001 Cause No.: 2009-002803	2010-2012
Mr. Keith Patton Shrader & Associates, L.L.P. 3900 Essex Lane, Suite 390 Houston, TX 77027	Plaintiff(s): Richard Czuprynski Defendant: The Kansas City & Southern Railway Company Circuit Court of Jackson County, Missouri (Supporting Plaintiff)	Benzene from Benzene-Containing Products Deposed by Defendant 11/29/2011	Dismissed	SHR-11-001 Cause No.: 1016-CV06186, Division No. 4	2011-2012
Mr. Greg Coolidge Metzger Law Group 401 E. Ocean Blvd., Ste. 800 Long Beach, CA 90802	Plaintiff(s): Steven Billing et al. Defendant(s): Azko Nobel Paints, LLC et al. Superior Court of the State of California for the County of Los Angeles (Supported Plaintiffs)	Benzene Exposure	Negotiated Settlement 01/2012	MET-11-001 Case No.: BC 416990	2011-2012
Mr. Brian Madden Wagstaff & Cartmell, LLP 4740 Grand Avenue, Suite 300 Kansas City, MO 64112	Plaintiff(s): Charles Ross and Rocio Ross Defendant(s): Chevron Phillips Chemical Company, LP; Chevron Phillips Chemical Holdings II, LLC; and Chevron Phillips Chemical Company, LLC. District Court of Montgomery County, Texas, 284th Judicial District (Supported Plaintiffs)	Benzene Exposure Deposed by Defendant(s) 04/24/2012	Negotiated Settlement 03/2012	WAG-11-001 Case No.: 10-02-01901CO	2011-2012

Mr. Keith Hyde Provost Humphrey P.O. Box 4905 Beaumont, Texas 77704	Plaintiff(s): Jo Beth Allen and Lisa Wolfe, Surviving Children of Joe Allen, Deceased Defendant(s): Texaco, Inc., Chevron USA, Inc. and Atlantic Richfield Company In the District Court, Jefferson County, Texas, 60th Judicial District (Supported Plaintiffs)	Benzene Exposure	Negotiated Settlement 03/2012	PRO-11-001 Cause No. B-186,652	2011-2012
Ms. Jo Anna Pollock Simmons Attorneys At Law 707 Berkshire Blvd. P.O. Box 521 East Alton, IL 62024	Plaintiff(s): City of Roxana Defendant(s): Shell Oil Company, Equilon Enterprisers, LLC d/b/a Shell Oil Products, US, a Corporation, ConocoPhillips Company, WRB Refining LP, ConocoPhillips WRB Partner, LLC, and Cenovus GPCP, LLC. The Circuit Court Third Judicial Circuit Madison County, IL (Supported Plaintiffs)	Benzene Exposure Deposed by Defendant(s) 11/05/2015	Negotiated Settlement 2016	SIM-11-001 Case No.: 3:12cv-00336 GDM-PMF	2011-2016
Mr. Brad Oldaker Bailey, Stultz, Oldaker & Greene 122 Court Avenue Weston, WV 26452	Plaintiff(s): Ralph E. Taylor, Kathy Taylor, individually and in their capacity as guardian and next friend of Jane Doe, a minor. Defendant(s): E.I. Du Pont & Company, a Delaware Corporation, KBR, Inc., a Delaware Corporation, BE&K Construction Company, L.L.C., a Delaware Corporation and Debra Hartman, an Individual. In the Circuit Court of Kanawha County, West Virginia. (Supported Plaintiff)	Safety (Scaffold Incident)	Negotiated Settlement 09/2012	OLD-11-001 Case No. 11-C-1713	2011-2012
R. Dean Hartley Hartley & O'Brien, PLLC The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff(s): Cynthia L. Gunto, Individually and as Executrix of the Estate of Michael T. Gunto, deceased. Defendant(s): PPG Industries, Inc. Circuit Court of Marshall County, West Virginia (Supported Plaintiff)	Benzene Exposure	Negotiated Settlement 03/2013	HAR-11-001 Case No.: 09 C 260K	2011-2013
Mr. Gary L. Hall Smith, Rolfes & Skavdahl Co., LPA 600 Vine Street, Suite 2600 Cincinnati, OH 45202	Plaintiff(s): Rex A. Absher and Cosetta Absher Defendant(s): State Auto Insurance Company of Ohio In the Court of Common Pleas Lawrence County, Ohio. (Supported Insurance Company - Defendant)	Formaldehyde Exposure Deposed by Plaintiffs 02/09/2012	Decision in Favor of Plaintiff	STE-12-001 Case No.: 10OC-908	2011-2012
Dr. Herschel L. Hobson Hobson & Bradley Attorneys At Law 2190 Harrison Beaumont, TX 77701	Plaintiff(s): William P. Hite and Patricia A. Hite Defendant(s): Apex Oil Company, Inc., Valero Energy Corp., successor in interest to Clark Oil Company and Premcor, Inc. et al. Circuit Court of Cook County Illinois, County Department, Law Division	Benzene Exposure Deposed by Defendant(s) 04/02/2013	Negotiated Settlement 2/2014	HOB-11-001 Case No.: 09 L 4510	2011-2014

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
	(Supported Plaintiff)				
Mr. Ted Gianaris Simmons Attorneys At Law 707 Berkshire Blvd. P.O. Box 521 East Alton, IL 62024	Plaintiff(s): James and Betty Cox Defendant(s): Shell Oil Company, Equilon Enterprisers, LLC d/b/a Shell Oil Products, US, a Corporation, ConocoPhillips Company, WRB Refining LP, ConocoPhillips WRB Partner, LLC, and Cenovus GPCP, LLC. (Supported Plaintiffs)	VOC Exposure Site Visit, Interview and Report	Resolved Pre-Litigation 2014	SIM-12-001	2012-2014
Mr. Keith Hyde Provost Humphrey P.O. Box 4905 Beaumont, Texas 77704	Plaintiff(s): Claude W. Shute & Arthur Earl Holmes Defendant(s): Citgo Petroleum Company; Canadianoxy Offshore Production Co., ConocoPhillips Company; ExxonMobil Corporation; Chevron U.S.A., Inc.; Texaco, Inc.; Fina, Inc.; GATX Corporation; Crown Petroleum Corporation; Shell Oil Company; Hartford Accident & Indemnity Company; Century Indemnity Company and Lloyds of London In the 14th Judicial District Court of Calcasieu Parish, Louisiana (Supported Plaintiffs)	Benzene Exposure	Negotiated Settlement 09/2012	PRO-12-001 Cause No.: 2010-003436 "E"	2012
Mr. Andrew DuPont Locks Law Firm The Curtis Center 601 Walnut Street, Suite 720 East 170 South Independence Mall West Philadelphia, Pennsylvania 19106	Plaintiff(s): Sondra Krem, Individually and as Executrix of the Estate of Joseph J. Krem Defendant(s): BP Corporation North America, Inc., Atlantic Richfield Company, Sunoco, Inc. (R&M) f/k/a Sun Company, Inc., Radiator Specialty Company, United States Steel Corporation, Safety-Kleen Systems d/b/a Safety-Kleen, Safety-Kleen Corp. in its own right and d/b/a Safety-Kleen Systems, Inc., The Pep Boys-Manny, Moe & Jack, The Berkebile Oil Company, Inc. and CRC Industries, Inc. In the Court of Common Pleas of Philadelphia County, Pennsylvania – Civil Division (Supported Plaintiff)	Benzene Exposure	Negotiated Settlement 11/2012	LOC-12-001 Case No.: 01913	2012
Mr. Andrew J. Stern Kline & Specter 1525 Locust Street Philadelphia, PA 19102	Plaintiff(s): Ruben Grigoryants and Mariana Grigoryants Defendant(s): Safety-Kleen Systems d/b/a Safety-Kleen, Safety-Kleen Corp. in its own right and d/b/a Safety-Kleen Systems, Inc. In the United States District Court for the Western District of Pennsylvania (Supported Plaintiffs)	Benzene Exposure	Negotiated Settlement 04/2016	KLI-12-001 Case No.: 1:11-cv-00267-SJM	2012-2016
Mr. Andrew DuPont Locks Law Firm The Curtis Center 601 Walnut Street, Suite 720 East 170 South Independence Mall West	Plaintiff(s): David Gerchman and Teresa Gerchman Defendant(s): Berryman Products, Inc.; CRC Industries, Inc., Ford Motor Company, Loctite Corporation n/k/a Henkel Corporation; Illinois Tool Works, Inc., solely as successor-ininterest to Permatex, Inc.; Radiator Specialty Company;	Benzene Exposure Deposed by Defendant(s) on July 16, 2012.	Negotiated Settlement 08/2012	LOC-12-002 Case No. VC060106	2012-2012

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
Philadelphia, Pennsylvania 19106	United States Steel Corporation, Safety-Kleen Corp., SafetyKleen Systems, Inc., 3M Company; E.I. DuPont de Nemours & Company; Sea Foam Sales Company; Justice Brothers, Inc.; Hanson Merrill Corporation a/k/a Ernie's Auto Parts and Henkel Corporation In the Superior Court of the State of California for the County of Los Angeles, Southeast District (Supported Plaintiffs)				
Mr. Thomas E. Schwartz Holloran White & Schwartz LLP 2000 S. 8th Street St. Louis, Missouri 63104	Plaintiff(s): Jeannette Platt, as the surviving wife of Decedent Lawrence Platt, Lukas Platt and Zachary Platt, as the surviving children of Decedent, Loretta Platt, as the surviving mother of Decedent, and Francis Platt, John Platt and Edward Platt, as the surviving siblings of Decedent Defendant(s): BASF Corporation, D&A Distributing, Inc., E.I. DuPont de Nemours & Company, Link Motor Supply Company, Inc., PPG Industries, Inc., and the Sherwin Williams Company In the Circuit Court of St. Louis County, State of Missouri (Supported Plaintiffs)	Benzene Exposure	Negotiated Settlement 02/2013	SCH-12-001 Case No.: 10SL-CC01305	2012-2013
Mr. Keith Hyde Provost Humphrey P.O. Box 4905 Beaumont, Texas 77704	Plaintiff(s): Billy Smallwood & George C. Washington Defendant(s): Exxon Mobil Corporation et al. In the 136th Judicial District Court of Jefferson County, Texas (Supported Plaintiffs)	Benzene Exposure Deposed by Defendant(s) on October 17, 2013	Negotiated Settlement 11/2013	PRO-12-002 Case No.: D-189,648	2012-2013
Mr. Andrew DuPont Locks Law Firm 1500 Walnut Street, 20th Floor Philadelphia, PA 19102	Plaintiff(s): Andre A. Harvey Defendant(s): Valero Energy Corporation, PBF Energy Company, LLC, Paulsboro Refining Company, LLC, Sunoco, Inc. (R&M) a/k/a Sun Oil Company, Inc. and Sun Company, Inc., Sunoco Logistics Partners, L.P., El Paso Corporation, The Carlyle Group, L.P., Delaware City Refining Company, LLC, Husky Energy, Inc., Lima Refining Company In the Court of Common Pleas of Philadelphia County (Supported Plaintiff)	Benzene Exposure	Negotiated Settlement 01/20/2017	LOC-12-003 Case No. 121102430; 02471	2012-2017
Mr. Brian E. Fritz Saltz, Mongeluzzi, Barrett & Bendesky, P.C. One Liberty Place, 52nd Floor Philadelphia, PA 19103	Plaintiff(s): Jeanne Gans, Administratrix of the Estate of George Gans, and in her own right Defendant(s): Sunoco, Inc., and Sunoco (R&M) Inc. Philadelphia County Court of Common Pleas Law Division (Supported Plaintiff)	Benzene Exposure	Negotiated Settlement 3/2014	SMBB-13-001 Case No.: 03399	2013-2014

Mr. Guy R. Bucci Bucci Bailey & Javins LC PO Box 3712	Plaintiff(s): William (Rick) Potter Defendant(s): B&F Contracting, Inc. and its successors 198	Fall Protection	Negotiated Settlement 5-2015	BUC-13-002	2013-2015

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
Charleston, WV 25337 Mr. Chris Heavens Heavens Law Firm PLLC 2438 Kanawha Blvd., East Charleston, WV 25311	State Road 716, Ashland KY 41102 (Supported Plaintiff)	Pre-Suit – Wrote Expert Report			
Mr. Guy R. Bucci Bucci Law Firm PO Box 3712 Charleston, WV 25337	Plaintiff(s): Muriel A. Thomas and Jackie Thomas, her husband Defendant(s): Interiors Plus, LLC, a West Virginia Limited Liability Company, CENTAUR Floor Systems, LLC, ECORE International, Inc. a Pennsylvania Corporation, and Russell Morrison d/b/a/ Alpha Professional, vs. Bostic, Inc., ThirdParty Defendant In the Circuit Court of Kanawha County, West Virginia (Supported Plaintiffs)	Exposure to MDI	WV Workers' Compensation Office of Judges Decision of Reversal in Favor of Plaintiffs 12/19/2014 Negotiated Settlement 05/2016	BUC-13-001 Case No.: 14-C-106	2013-2016
Mr. Brian E. Fritz Saltz, Mongeluzzi, Barrett & Bendesky, P.C. One Liberty Place, 52nd Floor Philadelphia, PA 19103	Plaintiff(s): John and Jacquelyn Coen, Husband and Wife Defendant(s): Carboline Co., RPM, et al. Philadelphia County Court of Common Pleas Law Division (Supported Plaintiffs)	Benzene Exposure	Negotiated Settlement 11/2013	SMBB-13-002 Case No.: 1714	2013
Ms. Jo Anna Pollock Simmons Attorneys At Law 707 Berkshire Blvd. P.O. Box 521 East Alton, IL 62024	Plaintiff(s): Bridgeton Class Action – Marsha Buck, Troy Lewis, Jean Lewis, Mike Head and Janet Head, individually and on behalf of all others similarly situated. Defendant(s): Republic Services, Inc., Allied Services LLC d/b/a Republic Services of Bridgeton, Bridgeton Landfill, LLC In the United States District Court Eastern District of Missouri. (Supported Plaintiffs)	Benzene Exposure Deposed by Defendant(s) 10/30/2013	Negotiated Settlement 2013	SIM-13-002 Case No.: 13-CV-00801	2013
Mr. Douglas J. May Travelers Staff Counsel 625 Eden Parkway, Suite 510 Cincinnati, OH 45202	Plaintiff(s): Arshot Investment Corporation, et al. Defendant(s): E.V. Bishoff Company, et al. In the Court of Common Pleas Franklin County, OH (Supported Defendant – Mason)	Brick Veneer Failure Structural at Hampton Inn, Columbus, OH Site visit and Expert Report	Negotiated Settlement 2/2014	TRA-13-001 Case No.: 12CV-10-12920	2013-2014

Mr. John Vincent Weston Hurd LLP 10 W. Broad St., Suite 400 Columbus, OH 43215	Plaintiff(s): Tutor Time 123 LLC Defendant(s): Air Force One, Inc. Pre-Lawsuit (Supporting Defendant)	HVAC Failure Claimed Site Visit and Expert Report	Settled 2013	WES-13-001 Claim #: NR-CMM-6050718-110913-A	2013

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
Mr. Andrew DuPont Locks Law Firm 1500 Walnut Street, 20th Floor Philadelphia, PA 19102	Plaintiff(s): David A. Johnson and Laura Johnson Defendant(s): Armored Autogroup, Inc. d/b/a STP; Berryman Products, Inc.; CRC Industries, Inc., Loctite Corporation n/k/a Henkel Corporation; Illinois Tool Works, Inc., solely as successor-in-interest to Permatex, Inc.; Radiator Specialty Company; United States Steel Corporation, Safety-Kleen Corp., Safety-Kleen Systems, Inc., 3M Company; Texaco, Inc.; Chevron U.S.A., Inc., Individually and Successor in Interest to Texaco, Inc., Justice Brothers, Inc.; Genuine Parts Company; Henkel Corporation Individually and as Successor in Interest to Loctite Corporation and Henkel Loctite Corporation; Sunoco, Inc. (R&M); Volvo Cars, etc. In the Superior Court of the State of California for the County of Alameda (Supported Plaintiffs)	Benzene Exposure Deposed by Defendant(s) 3/21/2014; 4/8/2014; 4/24/2014	Negotiated Settlement 6/2014 Re-opened 2016 and resettled 9/2016	LOC-13-001 Case No.: 001641 A142485 In the Court of Appeal of the State of California, First Appellate District	2013-2016
Mr. Andrew DuPont Locks Law Firm 1500 Walnut Street, 20th Floor Philadelphia, PA 19102	Plaintiff(s): David Butler and Teri Rhodes Defendant(s): Sunoco, Inc. (R&M) FKA Sun Company, Inc. FKA Sun Oil Company; United States Steel Company; and Radiator Specialty Company. In the Court of Common Pleas of Philadelphia County, Pennsylvania Civil Division (Supported Plaintiffs)	Benzene Exposure	Testified in Trial 7/29-30/2014 Decision in Favor of Defense 8/8/2014	LOC-13-001 Case No.: 001641	2013-2014
Mr. Thomas E. Schwartz Holloran White & Schwartz, LLP 2000 South 8th Street St. Louis, MO 63104	Plaintiff(s): Elroy Buyat, Jr. Defendant(s): Mallinckrodt, Inc., Covidien, Inc., Safety-Kleen Systems, Inc., Heritage-Crystal Clean, LLC., and Engineered Lubricants, Co In the Circuit Court of St. Louis County, State of Missouri (Supported Plaintiff)	Benzene Exposure	Negotiated Settlement 2014	HOL-13-001 Case No.: 1122-CC00786	2013-2014

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
Mr. Andrew DuPont Locks Law Firm 1500 Walnut Street, 20th Floor Philadelphia, PA 19102	Plaintiff(s): Layne Kleinschmit and Cynthia Kleinschmit Defendant(s): 3M Company; Berryman Products, Inc.; The Blaster Corporation, CRC Industries, Inc., Genuine Parts Company, d/b/a NAPA; Henkel Corporation, individually and as successor in interest to Loctite Corporation and Henkel Locktite Corporation; Loctite Corporation n/k/a Henkel Corporation; Illinois Tool Works, Inc., d/b/a Permatex and d/b/a Gumout and d/b/a LPS Laboratories and d/b/a Wynn's.; The Pep Boys – Manny, Moe & Jack; Radiator Specialty Company; Safety-Kleen Corporation, Safety-Kleen Systems, Inc., Sunoco, Inc. (R&M) f/k/a Sun Company, Inc. and f/k/a Sun Oil Company, Inc., Technical Chemical Company; and United States Steel Corporation In the Court of Common Pleas, Philadelphia County (Supporting Plaintiffs)	Benzene Exposure	Negotiated Settlement 06/2015	LOC-14-001 Case No. VC060106	2013-2015
Mr. Mark R. Staun The Segal Law Firm 810 Kanawha Boulevard, East Charleston, West Virginia 25301	Plaintiff(s): Steve Ansell Defendant(s): EXXON MOBIL CORPORATION, a New Jersey corporation; SAFETY-KLEEN SYSTEMS, INC., a Wisconsin corporation; RADIATOR SPECIALTY COMPANY, a North Carolina corporation; CRC INDUSTRIES, INC., a Pennsylvania corporation; WEST VIRGINIA, DEPARTMENT OF TRANSPORTATION, DIVISION OF HIGHWAYS, an agency of the State of West Virginia; NAZDAR COMPANY, Individually and as Successor-by-Acquisition/Merger to ADVANCE PROCESS SUPPLY CO., an Illinois corporation; ADVANCE PROCESS SUPPLY CO., an Illinois corporation; 3M COMPANY, a Delaware corporation; FUJIFILM NORTH AMERICA CORPORATION, as Successor-by Merger to FUJIFILM SERICOL U.S.A., INC., as Successor-by-Merger to SERICOL, INC., a New York corporation; UNCOMMON CONGLOMERATES, INC., a Division of CYBERBOND, LLC, a Delaware limited liability company Circuit Court of Marshall County, West Virginia (Supported Plaintiff)	Benzene Exposure	Negotiated Settlement 2015	SEG-13-001 Case No.: 13-C119K	2013-2015
Mr. John Vincent Weston Hurd LLP 10 W. Broad St., Suite 400 Columbus, OH 43215	Plaintiff(s): Mercer Square, LLC Defendant(s): Preferred Real Estate Pre-Suite Inspection and Report (Supported Defendant)	Fire Suppression System Freeze Failure Jack Nicklaus Villa – 18th Green – Muirfield Village, Dublin, OH	Negotiated Settlement 2014	WES-14-001	2014

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
Mr. Darren Brown Provost Umphrey 490 Park Street Beaumont, TX 77704	Plaintiff(s): Carl Nolan Smith, III Defendant(s): Chevron U.S.A., Inc.; Chevron Chemical Company, LLC; ExxonMobil Oil Corporation; Texaco, Inc.; Atlantic Richfield Company; BP Amoco Chemical Company; BP Products North America, Inc.; Canadianoxy Offshore Production Co.; ConocoPhillips Company; Total Petrochemicals USA, Inc.; Union Oil Company of California; and Huntsman Petrochemical, Inc. 14th Judicial District Court, Parish of Calcasieu, State of Louisiana (Supported Plaintiff)	Benzene Exposure	Negotiated Settlement 10/2014	PRO-14-001 Cause No.: 2012-5290A	2014
Mr. Robert Black Black Law, PC The Lyric Centre 440 Louisiana, Suite 2400 Houston, Texas 77002	Plaintiff(s): Joseph Dwayne Meeks and Jane Meeks Defendant(s): Ace Hardware, British Petroleum (BP); E.I. du Pont de Nemours and Company (DuPont), Pittsburg Paint Glass (PPG), Savogran; Shell Oil Company (Shell); SherwinWilliams Company (S-W), W.M. Barr & Company (WM Barr), and US Steel Company. Galveston County, Texas – 122nd District Court (Supported Plaintiffs)	Benzene Exposure	Negotiated Settlement 09/2015	BLA-14-001 Cause No.: 14-CV-1044	2014-2015
Mr. Scott R. Frieling Allen Stewart, P.C. 325 N. St. Paul St., Ste. 2750 Dallas, TX 75201	Plaintiff(s): Thomas Koenig and Rebecca Koenig Defendant(s): Ashland, Inc., BASF Corporation, Dow Chemical Company, Dynabrade, Inc., E.I. DuPont de Nemours & Co., Egyptian Lacquer Manufacturing Company, Inc., GE Betz, Inc., Henkel Corporation, NB Coatings, Inc., Zinsser Co., Inc. as successor to Parks Corporation, Plastic Process Equipment, Inc., Rohm & Hass Company, Worwag Coatings, LLC. In the Court of Common Pleas, Philadelphia County, PA (Supporting Plaintiff)	Benzene Exposure	Negotiated Settlement 04/2015	ALL-14-001 Cause No.: 12-12-03188	2014-2015
Mr. Scott R. Frieling Allen Stewart, P.C. 325 N. St. Paul St., Ste. 2750 Dallas, TX 75201	Plaintiff(s): Jerri A. Rowan Defendant(s): Sherwin-Williams, Inc., Columbia Forest Products, Inc., Futch Lumber, FTL Properties of Delaware, LLC, Baer Wurth, Aetna, Charter Industries, Temple-Inland, Inc., Tamarac Distributors, Charles F. Shiels, Bluelinx, Flagg, ATC Panels, Inc., Georgia Pacific Wood Products, Weyerhaeuser, Jeld-Wen, Inc., Custom Plywood, Rugby, Inc., Distributor Service, Inc., In the Court of Common Pleas, Cuyahoga County, OH (Supporting Plaintiff)	Benzene Exposure	Negotiated Settlement 01/2015	ALL-14-002 Cause No.: CV 13 813181	2014-2015

Mr. Peter Alfert Hinton Alfert & Kahn LLP 200 Pringle Ave., Suite 450 Walnut Creek, CA 94596	Plaintiff(s): Gavin Kirk, a minor by and through his guardian ad litem Stephen Tobin Kirk, Sarah Kirk, and Stephen Tobin Kirk individuals, Ryan Goode, a minor by and through his guardian ad litem James Goode, Jaqueline Goode and James Goode individuals Defendant(s): Varco International, Inc., Varco Heat Treating Company, Varco Oil Tools, National Oil Well Varco, Plazamerica Inc., Plaza National Real Estate, Inc., Plaza Atrium, Inc., Leed Plaza Atrium, LLC., successor in interest to Plazamerica, Inc., Leed Properties, Cove Properties, Inc., Cove Development Co., Cove Builders, Inc., County of Orange, and Does 1 through 200, inclusive. In the Superior Court of the State of California, for the County of Orange (Supporting Plaintiffs)	Soil/Gas Exposure Deposed by Defendant(s) 07/31/ 2015	Negotiated Settlement 02/2016	HIN-14-001 Cause No.: 30-2010-00423097 & 30-2011-00512364 Consolidated	2014-2016

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
Mr. Timothy O'Brien Levin Papantonio 316 S. Baylen St.., #600 Pensacola, FL 32502 Mr. Robert Bilott Taft Stettinius & Hollister LLP 425 Walnut Street, Suite 1800 Cincinnati, OH 45202 Mr. Richard Schulte Wright & Schulte 812 E. National Road Vandalia, OH 45377	Plaintiff(s): C-8 Class Action Defendant(s): DuPont de Nemours United States District Court Southern District of Ohio – Eastern Division (Supporting Plaintiffs)	Exposure to C-8 Deposed by Defendant(s) 03/30/2015 Daubert Challenge by Defendant(s) – Denied August 6, 2015	Case 1 Bartlett - Testified in Trial 09/21, 22, 23/2015 Case 1 Decision in favor of Plaintiff Carla Bartlett 10/7/2015 Case 2 Freeman – Testified in Trial 06/10, 13, 14, 15/2016 Case 2 Decision in favor of Plaintiff David Freeman 07/08/2016 Case 3 Vigneron – Testified in Trial 12/1 & 5/2016 Case 3 Decision in favor of Plaintiff Keith Vigneron 01/05/2017 Case 4 Moody – 01/30, 31, and 02/ 1/2017 Case 4 Larry Moody - Part of Class Action Negotiated Settlement of 900 Million + 02/13/2017	WRI-14-001	2014-2017

Mr. Emmett McGowan Nelson Brown & Co. 518 Township Line Road, Suite 300 Blue Bell, PA 19422	Plaintiff(s): Alva & Fern Hoopengardner Defendant(s): Meridian Citizens Mutual Insurance Company United States District Court Eastern District of Pennsylvania (Supported Defendant)	Indoor Air Quality (IAQ)	Negotiated Settlement 2014	NEL-14-001 Cause No.: 2:13-cv-07485PD	2014
Mr. Scott R. Frieling Allen Stewart, P.C. 325 N. St. Paul St., Ste. 2750 Dallas, TX 75201	Plaintiff(s): Wade Wesley Wiederhold Defendant(s): Safety Kleen, Corp., Safety Kleen Systems, Inc., Rust-Oleum Corp., Berryman Products, Inc., ITW Permatex, a Division of Illinois Tool Works, Inc., The Valspar Corporation, Henkel Corporation, Deere & Company, Gold Eagle Co., The Sherwin-Williams Company, Apollo Industries, Inc., Claire-Sprayway, Inc., and Ozark Kenworth, Inc. In the Circuit Court of Jackson County, Missouri 2 at Independence (Supported Plaintiff)	Benzene Exposure Deposed by Defendant(s) 10/22/2015	Testified in Trial on 06/21/2016 Decision in favor of Defendant 07/2016	ALL-14-002 Case No.: 1316-CV13192	2014-2016
Mr. Andrew DuPont Locks Law Firm 1500 Walnut Street, 20th Floor Philadelphia, PA 19102	Plaintiff(s): Louis Arthur DeSorbo Defendant(s): United States Steel Corporation; Sunoco, Inc. (R&M) f/k/a Sun Company, Inc. and f/k/a Sun Oil Company, Inc.; 3M Company; Rogersol, Inc., Rycoline Products, Inc., a Division of Sun Chemical Commercial Group a/k/a Rycoline Products, LLC and Successor to Rogersol, Inc.; Sun Chemical Corporation, Individually and a Parent and Successor to Rycoline Products, LLC, a/k/a Rycoline Products, Inc. and Successor to Rogersol, Inc.; Van Son Holland Ink Corporation of American; Varn International, d/b/a Varn Products Company; Day International, Inc., Individually and as Successor to and d/b/a Varn Products Company; Printers Service d/b/a Prisco; Deleet Merchandizing Corporation; Cabrun Ink Products, Corporation; Handschy Industries, LLC; Chevron USA, Inc. Individually and as Successor In Interest to Unocal Corporation and its Subsidiaries; Philips Electronics North America Corporation d/b/a and a Parent and Successor In Interest .H. Agriculture and Nutrition, Inc. and ThompsonHayward Chemical Company; Emco Chemical Distributors, Inc.; PPG Industries, Inc.; Shell Oil Company; Shell Oil Products US, INC.; Fisher Scientific International, Incorporated; Mallinckrodt Baker, Incorporated, Individually and as Successor In Interest to J.T. Baker, Incorporated; Total Petrochemicals & Refining USA, Incorporated, Individually and as Successor In Interest to American Petrofina, Inc. Total Plaza a/k/a FINA, Inc., Cosden Oil Company, Graphic Packaging International, Inc. Individually	Benzene Exposure	Testified in Trial 02/10/2016 Decision in Favor of Plaintiff 02/2016	LOC-14-002 Cause No. 003450	2014-2016

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
	and Successor in Interest to Handschy Industries, LLC.; Anchor/Lith-Kem-Ko, Incorporated, a Subsidiary of FugiFilm Hunt Chemicals USA, Incorporated; FugiFilm Hunt Chemicals USA, Incorporated, d/b/a and Parent and Successor to Anchor/Lith-Kem-Ko, Incorporated; Sinclair & Valentine Company, Incorporated; Hurst Chemical Company; Gans Ink & Supply Company, Incorporated; Spinks Ink Company, Incorporated; Flint Ink Corporation; et al. In the Court of Common Pleas, Philadelphia County, Pennsylvania (Supported Plaintiff)				
Allen Stewart Stephanie Sherman 325 N. St. Paul St., Suite 2750 Dallas, TX 75201	Plaintiff(s): Christopher Lightfoot Defendant(s): Georgia-Pacific Wood Products LLC, GeorgiaPacific, LLC, individually and as successor-in-interest to Georgia-Pacific Corporation, Weyerhaeuser Company, Weyerhaeuser NR Company, Lowes Home Centers, LLC (NC), and John Doe 1 State Court of Fulton County, GA (Supported Plaintiff)	Wood Dust Exposure	Negotiated Settlement 2016	ALL-15-001 Cause No.: 01960	2015-2016
Mr. Darren Brown Provost Humphrey P.O. Box 4905 Beaumont, Texas 77704	Plaintiff(s): Cathy Withers Defendant(s): Chevron U.S.A., Texaco, Inc., Union Oil Company of California, Alon USA, LP, Anadarko E & P Onshore, LLC, ConcoPhillips Company, ExxonMobil Oil Corporation, PB Amoco Chemical Company, BP Products North America, Inc., Canadianoxy Offshore Production Company, Citgo Petroleum Corporation, Delek Logistics Operating, LLC, Total Petrochemicals & Refining, USA,, Inc., El Paso Energy E.S.T. Company, El Paso Natural Gas Company, LLC, Enbridge Marketing LLC, Targa Resources, Axiall Georgia Gulf Corp., Hunt Oil Company, et al. In the 14th Judicial District Court for the Parish of Calcasieu, State of Louisiana, Division "D"	Benzene Exposure	Negotiated Settlement 12/2016	PRO-15-001 Cause No.: 2013-3723	2015-2016
Kohrman Jackson & Krantz Ms. Heather Zilka 10 West Broad Street, Suite 1900 Columbus, OH 43215	Plaintiff(s): Mary Christian Defendant(s): Lawrence Water, et al. Lawrence County Common Pleas, Ohio (Supported Defendant)	Structural Damage from Water Leak	Negotiated Settlement 10/2016	KJK (SMI)-15-001 Cause No.: 14 OC 739	2015-2016
Mr. Everett Day Black Law, PC The Lyric Centre 440 Louisiana, Suite 2400 Houston, Texas 77002	Plaintiff(s): Yomanoh Akpobo Defendant(s): Ross Dress for Less, Inc., Houston, TX American Arbitration Association Arbitration Proceedings – Employment Arbitration	Slip & Fall	Negotiated Settlement 07/2017	BLA-15-001 Cause No.: 01-15-0005-2333	2015-2017

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
	(Supported Plaintiff)				
Mr. John E. Tomlinson Beasley, Allen, Crow, Methvin, Portis & Miles, P.C. 218 Commerce Street Montgomery, AL 36104	Plaintiff(s): Sheila D. Keenum, Individually, and as Personal Representative of the Estate of Wendell Joe Keenum, deceased Defendant(s): E. I. du Pont de Nemours and Company; PPG Industries, Inc.; SEM Products, Inc.; The Valspar Corporation; Rust-Oleum Corporation; O'Reilly; Automotive Stores, Inc.; R. & R. Bumper & Body Supply, Inc.; Detail Supply, LLC; Sam T. Carter Oil Company, Inc.; The SherwinWilliams Company; Hunt Refining Company; One Shot LLC; Cumberland Products Incorporated; Powers Paper Company, and Fictitious Defendant(s) "1 through 100. In the Circuit Court of Colbert County, Alabama. (Supported Plaintiff)	Exposure to Paint Products Deposed by Defendant(s) 09/30/2020	On-going	BEA-16-001 Case #: 20-CV-2016900050.	2016-Present
Mr. Chris Heavens Heavens Law Firm PLLC 2438 Kanawha Blvd., East Charleston, WV 25311	Plaintiff(s): Dominick Hall Defendant(s): Silicon Processors, Inc. In the Circuit Court of Wood County, WV (Supported Plaintiff)	Personal Injury Deposed by Defendant(s) 08/09/2017	Negotiated Settlement 10/2017	HEA-15-001 Case No: 15-C-471	2015-2017
Mr. Andrew Lipton Hobson & Bradley 2190 Harrison Beaumont, TX 77701	Plaintiff(s): Herbert C. Cowart Defendant(s): ExxonMobil, Hess, Chevron/Texaco, Keystone Shipping, ConocoPhillips, Canadianoxy Offshore Production Company, Coastal Fuels Marketing Company, Shell Oil Company, Union Carbide Corporation, Signet Maritime Corporation, Kirby Inland Marine, LP, BP Products North America, Marathon Oil Company 14th Judicial District Court, Parish of Calcasieu, State of Louisiana, Division E (Supported Plaintiff)	Benzene Exposure	Negotiated Settlement 07/2017	HOB-16-001 Cause No.: 2004-3133	2016-2017
Ms. Jo Anna Pollock The Simmons Firm One Court Street Alton, IL 62002	Plaintiff(s): Gerald Dean Maberry Defendant(s): Shell Oil Company, Equilon Enterprises, LLC, d/b/a Shell Oil Products, US; ConocoPhillips Company; WRB Refining LP; ConocoPhillips WRB Partner LLC; Cenovus GPCO LLC; and, BP Products North America, Inc. In the Circuit Court for the Third Judicial Circuit, Madison County, IL (Supported Plaintiff)	Benzene Exposure	Negotiated Settlement 09/2016	SIM-16-001 Case No.: 15-L1193	2016

Mr. Robert Black Black Law, PC The Lyric Centre 440 Louisiana, Suite 2400	Plaintiff(s): Gregory A. Justice et al. Defendant(s): Radiator Specialty (DuPont), Savogran; Shell Oil Company (Shell); Sherwin-Williams Company (S-W), W.M. Barr & Company (WM Barr), and US Steel Company	Benzene Exposure	Negotiated Settlement 02/2017	BLA-16-001 Cause No.: 15CV-0907	2016-2017

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
Houston, Texas 77002	In the District Court of Galveston County, TX – 112nd Judicial District (Supported Plaintiffs)				
Mr. Robert Black Black Law, PC The Lyric Centre 440 Louisiana, Suite 2400 Houston, Texas	Plaintiff(s): Nin Koy Defendant(s): Steel Masters, LP, Steel Masters-GP LLC, and J.T. Vaughn Construction, LLC. In the District Court of Harris County, TX – 190th Judicial District (Supported Plaintiff)	Personal Injury - Finger Amputation	Negotiated Settlement 10/2016	BLA-16-002 Civil Cause No: 2015-01-01775	2016
R. Dean Hartley Hartley Law Group, PLLC The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff(s): Lee D. Tanked, Jr. and Cheryl Tankard, his wife. Defendant(s): Advance Auto Parts, Inc.; A.E. Lottes, Co., f/k/a Carquest Auto Parts #1, Inc. d.b.a. Carquest Store #2856; CQ Sourcing, Inc.; Walker Automotive Supply, Inc.; Safety-Kleen Systems, Inc.; CRC Industries, Inc.; 3m Company; and The B'Laster Corporation. In the General Court of Justice, Superior Court Division State of North Carolina, Wake County (Supported Plaintiffs)	Benzene Exposure	Negotiated Settlement 02-01-2020	HAR-16-002 Civil Cause: 16CVS-2949	2016-2020
Mr. David J. Carney Anapol Weiss One Logan Square 130 N. 18th St. Suite 1600 Philadelphia, PA 19103	Plaintiff(s): David S. Garrison and Laura Timmes-Garrison Defendant(s): Smiths Group, PLC; Saint-Gobain North America, d/b/a Saint-Gobain Performance Plastic Corporation, successor in interest to CHR Industries, Inc., and Dixon Industries Corporation, successor in interest to Penntube Plastics; Compressor Products International, LLC, successor in interest to Plastomer Products; Quaker City Chemicals, Inc.; Exxon Mobil Corporation; E.I DuPont de Nemours and Company, Inc. and W.N. Stevenson, Company Philadelphia County Court of Common Pleas, PA (Supported Plaintiffs)	Benzene Exposure	Negotiated Settlement 03/2018	ANA-16-001 Case No.: 001960	2016-2018

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
Mr. Chris Heavens Heavens Law Firm PLLC 2438 Kanawha Blvd., East Charleston, WV 25311	Plaintiff(s): Walter H. Jones, Jr. Defendant(s): Family Handyman Services of Barboursville, LLC, George E. Linkous, individually and as owner of Family Handyman Services of Barboursville, LLC, and Absolut Roofing, LLC In the Circuit Court of Kanawha County, WV (Supported Plaintiff)	Personal Injury – Fall from Roof	Negotiated Settlement 10/2017	HEA-16-001 Case No.: 15-C2059	2016-2017
Mr. Chris Heavens Heavens Law Firm PLLC 2438 Kanawha Blvd., East Charleston, WV 25311	Plaintiff(s): Paul Michalec and Jennifer Michalec Defendant(s): American Supply Company, Inc. In the Court of Common Pleas, Philadelphia County, PA (Supported Plaintiffs)	Personal Injury – Loading Dock Injury	Testified in Trial 07/07/2017 Decision by Jury for the Plaintiffs $573,000 07/17/2017	HEA-16-003 Civil Cause No. 000893	2016-2017
R. Dean Hartley Hartley Law Group, PLLC The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff(s): Mark A. Fitzpatrick and James Parrish and Monica Parrish, his wife Defendant(s): SAL Chemical Co., Inc., an Ohio Corporation, Chemical Solvents, Inc. an Ohio Corporation, Ball Aerosol and Specialty Containers Inc, f/k/a United States Can Company, an Indiana Corporation, Mall Metal Food Container, LLC f/k/a Ball Metal Food Container Corp., a Delaware LLC. In the Circuit Court of Brooke County, West Virginia (Supported Plaintiffs)	Benzene Exposure	Negotiated Settlement 01/2018	HAR-16-002 Case No,: 14-C-74	2016-2018
Mr. Chris Heavens Heavens Law Firm PLLC 2438 Kanawha Blvd., East Charleston, WV 25311	Plaintiff(s): Heckler Defendant(s): Ricottilli Lumber Company, Inc. Pre-Lawsuit (Supported Plaintiff)	Personal Injury – Sawmill Operations Accident	Cancelled	HEA-16-005	2016-2017
Mr. John (Rett) Guerry III Motley Rice LLC 28 Brigeside Blvd. Mt. Pleasant, SC 29464	Plaintiff(s): Jack S. Edison Defendant(s): CSX Transportation, Inc., individually and as successor-in-interest to Louisville & Nashville Railroad Company In the Circuit Court of Hamilton County, Tennessee (Supported Plaintiff)	Diesel fuel & Exhaust	Negotiated Settlement 08/2017	MOT-16-003 Case No.: 15-C-1407, Division 2	2016-2017

Ms. Jo Anna Pollock Simmons Hanly Conroy One Court Street Alton, IL 62002	Plaintiff(s): Joan Green, on behalf of the Estate of Thomas Albert Green, Deceased Defendant(s): 3M Company, Apex Oil Company, Inc., Clark Oil & Refining Corporation, Premcor Refining Group, Inc., Radiator Specialty Company, Safety-Kleen Corporation, Safety-Kleen Systems, Inc., Turtle Wax, Inc., United States Steel Corporation, et al In the Circuit Court Third Judicial Circuit, Madison County, Illinois (Supported Plaintiff)	Benzene Exposure	Negotiated Settlement 10/31/2018	16-004 Case No.: 15-L1418	2016-Present
Mr. David J. Carney Anapol Weiss One Logan Square 130 N. 18th St. Suite 1600 Philadelphia, PA 19103	Plaintiff(s): Jean Nelson, Executrix of the Estate of Charles Nelson, III, Deceased Defendant(s): BP Products North America, Inc. individually and as successor in interest to the Standard Oil Company d/b/a SOHIO In the United States District Court for the Eastern District of	Benzene Exposure Deposed on 06/28/2018	Negotiated Settlement 2018	ANA-16-002 Case No.: 2:16CV-04888-JP	2016-Present

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
	Pennsylvania (Supported Plaintiff)				
Mr. John (Rett) Guerry III Motley Rice LLC 28 Brigeside Blvd. Mt. Pleasant, SC 29464	Plaintiff(s): Jesse D. Roop Defendant(s): CSX Transportation, Inc., Individually and as Successor-in-Interest to Seaboard System Railroad, Seaboard Coast Line Railroad, Seaboard Air Line Railroad and Atlantic Coast Line Railroad State Court of Chatham County, Georgia (Supported Plaintiff)	Diesel Fuel & Exhaust/Benzene Deposed on 06/06/2019 Daubert Hearing 6/6/2020 – Motion Denied	Loss Summary Judgment 06/2020	MOT-16-001 Case No. STCV1600137S A	2016-2020
Mr. Colin King Dewsnup King & Olsen Law 36 South State Street, Suite 2400 Salt Lake City, UT 84111-0024	Plaintiff(s): Allan Flandro Defendant(s): Chevron Pipe Line Company, a Delaware Corporation; PacifiCorp, an Oregon Corporation dba Rocky Mountain Power; and Corporation of the President of the of the Church of Jesus Christ of Latter-Day Saints. Third Judicial District Court, Salt Lake County, Utah (Supported Plaintiff)	Chemical Exposure	Negotiated Settlement 03-01-2021	DEW-16-001 Case No. 180905235	2016-2021

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
Mr. David J. Carney Anapol Weiss One Logan Square 130 N. 18th St. Suite 1600 Philadelphia, PA 19103	Plaintiff(s): James R. Meyer (deceased) and Jeanette Meyer Defendant(s): Atlantic Richfield Company, BP Products North American, Inc., Chevron USA Inc. f/k/a Gulf Oil Corporation, Hess Corporation, ExxonMobil Oil Corporation, Sun Oil Company d/b/a Sunoco Incorporated, Exelon Corporation as parent to Philadelphia Electric Company, Philadelphia Gas Workers, Arcelormittal USA, LLC, United States Steel Corporation, Rohm & Haas Company, J.J. White Incorporated, Nooter Construction Company, Frank Lill & Son, Incorporated, United States Services Group, and Foster Wheeler Zack, Inc. Court of Common Pleas Philadelphia County, PA, Civil Division Supported Plaintiffs)	Benzene Exposure	Negotiated Settlement 01/2018	ANA-16-002 Case No. 15-07 -02328	2017-2018
Mr. Guy Bucci Bucci Bailey & Javins LC 112 Capitol Hill, Suite 200 Charleston, WV 25301	Plaintiff(s): Jo Ann Gore Defendant(s): The Kroger Company, an Ohio Corporation United States District Court for the Southern District of West Virginia at Charleston (Supported Plaintiff)	Personal Injury – Fall in Store	Negotiated Settlement 07/2017	BUC-17-001 Civil Action No.: 2:16-cv-09223	2017
Mr. Robert Black Black Law, PC The Lyric Centre 440 Louisiana, Suite 2400 Houston, Texas	Plaintiff(s): Leo Lippold and Stacy Lippold Individually, and as next friends for XXXXX XXXXXXX, a Minor Defendant(s): A-Pro Top Construction, RRE Armand Place Holding, LLC and Resource Real Estate Management Company In The District Court of Harris County, Texas 152nd Judicial District. (Supported Plaintiffs)	Personal Injury – Pool Fence Injury to Child – Spike Through Neck	Negotiated Settlement 10/2017	BLA-17-001 Cause No.: 2016-11087	2017
Mr. Brian Fritz Fritz Goldenberg & Bianculli 1515 Market Street, Suite 705 Philadelphia, PA 19102	Plaintiff(s): Thomas Timlin and Wendy Timlin, H/W Defendant(s): BP America, Inc., a/k/a BP Corporation, a/t/a Tosco, Sunoco, Inc. (R&M); Sunoco Partners Marketing and Terminals, LP; Sunoco Logistics Partners, LP; Sunoco Partners, LLC; Sunoco Chemicals, Inc.; Conoco Phillips; Phillips Petroleum Company; Chevron U.S.A, Inc.; Chevron Corporation; Braskem American, Inc.; Braskem S/A; Philadelphia Energy Solutions, LLC; Philadelphia Energy Solutions Refining & Marketing, LLC; Energy Transfer Partners GP, LP; Energy Transfer Partners, LLC; Energy Transfer Partners GP, LP; Citrus Corporation; Kinder Morgan, Inc., The Carlyle Group, LP; Carlyle Management Group Partners, LP; Carlyle Group Management, LLC; Epsilon Products Company, LLC; Honeywell, Inc.; Honeywell International, Inc.; Monroe Energy, LLC; Monroe Energy a/k/a MIPC, LLC, and/or MIPC, LLC. Court of Common Pleas Philadelphia County, PA (Supported Plaintiffs)	Benzene Exposure	Negotiated Settlement 02/2018	FRI-17-001 Case No.: 15-06-062709 Docket No.: 004033	2017-2018

Mr. Chris Heavens Heavens Law Firm PLLC 2438 Kanawha Blvd., East Charleston, WV 25311	Plaintiff(s): Darrell Fint Defendant(s): Brayman Construction, a Foreign Corporation In the United States District Court for the Southern District of West Virginia (Supported Plaintiff)	Personal Injury	Negotiated Settlement 04/2019	HEA-17-001 Civil Action No. 5:17-CV-04043	2017-2019
Mr. Andrew Lipton Hobson & Bradley 2190 Harrison Beaumont, TX 77701	Plaintiff(s): Arthur Whitfield Defendant(s): Alaska Tanker Company; Alyeska Pipeline Service Company; BP American Inc.; BP Amoco Chemical Company; BP Corporation North America, Inc.; BP Pipelines (Alaska), Inc.; BP Pipelines (North America), Inc.; BP Products North America, Inc.; Chevron Corporation, individually and as successor to Union Oil Company of California (Unocal) and Unocal Pipeline Company; Chevron USA, Inc.; ConocoPhillips Alaska, Inc.; ConocoPhillips Company; ConocoPhillips Transportation Alaska, Inc.; Crowley Marine Services, Inc., individually and as successor to Marine Transport Lines; Crawley Maritime Corporation, individually and as successor to Marine Transport Lines; Hess Corporation; Keystone Shipping Company, individually and successor to Shipco 669 Inc. and Shipco 2296 Inc.; Marine Transport Lines, Inc.; Petro-Diamond, Inc.; PetroDiamond Terminal Company; Phillips 66 Company; Phillips 66 Pipeline, LLC; and Shell Chemical, LP. In the District Court of Jefferson County, TX, 172nd Judicial District (Supported Plaintiff)	Benzene Exposure	On-Going	HOB-17-001 Cause No: E-198,379	2017-Present

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
Mr. Todd McPharlin Kelley Uustal 500 N. Federal Highway, Suite 200 Fort Lauderdale, FL 33301	Plaintiff(s): Polly O'Hara Defendant(s): HomeGoods, Inc. and Martha Prophete In the Circuit Court of the 17th Judicial Circuit in and for Broward County, Florida (Supported Plaintiff)	The standard of care required to protect workers and customers. Deposed on 04/12/2017	Negotiated Settlement 05/2018	KEL-17-001 Case No.: CACE16-007612	2017-2018
Mr. Craig Harris Trentalange & Kelley, P.A. 218 N. Dale Mabry Highway Tampa, FL 33609	Plaintiff(s): James R. Barber Defendant(s): Precision Shooting Equipment, Inc. In the Circuit Court of the Thirteenth Judicial Circuit in and for Hillsborough County, Florida (Supported Plaintiff)	PSE TAC Elite Crossbow Failure Deposed on 06/30/2017	Negotiated Settlement 05/2018	TRE-17-001 Case No. 2016-CA-005728-G	2017-2018

Mr. John (Rett) Guerry III Motley Rice LLC 28 Brigeside Blvd. Mt. Pleasant, SC 29464	Plaintiff(s): Judith Rosser, Individually and as Executrix of the Estate of Hayden Eugene Rosser, Dec Defendant(s): Norfolk Southern Railway Company, Individually and as Successor to Southern Railway Company, A Virginia Corporation In the United States District Court for the Middle District, North Carolina	Diesel Fuel & Exhaust and Benzene Deposed on 11/28/2017	Negotiated Settlement 05/2018	MOT-17-003 Case No.: 1: 16-CV-4-01	2017-2018
Mr. Guy Bucci Hendrickson & Long PLLC 112 Capitol Hill, Suite 200 Charleston, WV 25301	Plaintiff(s): Cantrell Defendant(s): STAT Pre-Lawsuit (Supported Plaintiff)	Personal Injury (Slip, Trip and Fall) Prepared Report	Negotiated Settlement 10/2018	HEN-17-002	2017-2018
Mr. Brian Madden Wagstaff & Cartmell, LLP 4740 Grand Avenue, Suite 300 Kansas City, MO 64112	Plaintiff(s): Mary Johnson et al. Defendant(s): Zill, LLC, MHS Environmental, Inc., et al. & The City of Kansas City, MO; The Kansas City Public Schools USD 33 a/k/a Kansas Public Schools, Land Bank of Kansas City Missouri, Brandon Dixon and Tiara Dixon, Inner City Oil Company, Inc. and Renee Wiggs and Bill Wiggs (third-party Defendant(s)) In The Circuit Court of Jackson County, Missouri at Kansas City (Supported Plaintiff)	Petroleum Contamination at/near Home Deposed on 12/06/2017	Negotiated Settlement 10/2018	WAG-17-001 Case No.: 1616-CV01151	2017-2018
Mr. Lon Walters The City Market 23A East Third Street Kansas City, MO 64106	Plaintiff(s): James Petrechko Defendant(s): BP Corporation North America Inc. and BP Products North America Inc. – Former American Oil Company (AMOCO) Site In the Circuit Court of Jackson County, Missouri at Independence (Supported Plaintiff)	Benzene Exposure Deposed on 1/10/2018	Negotiated Settlement 03/2018	WAL-17-001 Case No.: 1616-CV26094	2017-2018
R. Dean Hartley Hartley Law Group, PLLC	Plaintiff(s): Elijah P. Morris and Shirley J. Morris, his wife Defendant(s): Constellium Rolled Products Ravenswood,	Aromatic, Chlorinated, and	Negotiated Settlement	HAR-17-004	2017-2018

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	LLC, individually and as successor-in Interest to Kaiser Aluminum, Corporation, Ravenswood Aluminum Corporation, Century Aluminum Corporation of West Virginia, Inc., Pechiney Rolled Products, LLC, Alcan Rolled Products-Ravenswood, Rio Tinto Alcan, Inc., and Apollo Global Management, LLC, a Delaware Limited Liability Company et al. In the Circuit Court of Jackson West Virginia (Supported Plaintiffs)	Various Cutting Oils, Mists	2018	Civil Action No. 14-C-80	

Mr. John (Rett) Guerry III Motley Rice LLC 28 Brigeside Blvd. Mt. Pleasant, SC 29464	Plaintiff(s): Wendy Smith, Individually and as Personal Representative for the Estate of Jeremy O. Smith, Deceased Defendant(s): CAN Holdings, Inc. et al. State of South Carolina, County of Spartanburg, Court of Common Pleas, Seventh Judicial Circuit (Supported Plaintiff)	Diesel Fuel & Exhaust/Benzene Deposed on 6/04/2019	Negotiated Settlement 08/2019	MOT-17-004 Case No.: 2017-CP4202983	2017-2019
R. Dean Hartley Hartley Law Group, PLLC The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff(s): Dora Carbajal de Vences and Jose Luis Vences Sotelo, her husband Defendant(s): MAAX US Corp., Individually and as Successor-in-Interest by Aker Plastics Co., Inc., a Delaware Corporation; AOC, LLC; Arkema, Inc.; Axson US, Inc.; CTG International; Edgemate, Inc.; Evonik Corp.; Illinois Tool Works, Inc.; Jotun Paints, Inc.; Jowat Corporation; The Matchless Metal Polish Company; Multi-Tech Products, LLC; Performance Mineral Corp.; Sasol Chemicals North America, LLC; TR Industries, LLC; 3M Company, Individually and as Successor-by-Merger for/to Bondo Company; US Compliance Corp. In the Circuit Court of Berkley County, West Virginia (Supported Plaintiffs)	Chemical Exposure Deposed 06/25-26, 2019	Negotiated Settlement 01/2020	HAR-17-002 Case No.: 17-C98	2017-2020
Ms. Diana H. Crutchfield Berry, Kessler, Crutchfield, Taylor and Gordon 514 Seventh Street Moundsville, WV 26041 Mr. Guy Bucci Hendrickson & Long 214 Capitol Street Charleston, WV 25301	Plaintiff(s): Mr. Frank David Fullerton and Penny K. Fullerton Defendant(s): Bayer Corporation, an Indiana Corporation; Bayer MaterialScience, LLC, a Delaware Corporation; Covestro, LLC, a Delaware Corporation; Robert Baxter, Individually; Gary Durig, Individually; and Robert Greathouse, Individually Circuit Court of Marshall County, West Virginia (Supported Plaintiffs)	TDI Exposure Deposed on 06/13/2019	Negotiated Settlement 09/2020	BER-17-001 Civil Action No.: 11-C-197 K	2017-2020
Ms. Jo Anna Pollock Simmons Hanly Conroy One Court Street Alton, IL 62002	Plaintiff(s): James Andrew Spalo, an individual; and Mary Spalo, an individual Defendant(s): Union Pacific Railroad Company, Safety-Kleen Corporation, and Safety-Kleen Systems, Inc., et al.	RR Worker Deposed on 01/18/2019	Negotiated Settlement 02/2019	SIM-18-001 Case No.: 2017 L 3103	2018-2019

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
	In the Circuit Court of the First Judicial Circuit, Cook County, State of Illinois (Supported Plaintiffs)				

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
R. Dean Hartley Hartley Law Group, PLLC The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff(s): Judy Caruthers, Individually and as Administratrix of the Estate of Johnny Caruthers, Deceased Defendant(s): 3M Company, a Delaware Corporation; Ashland, LLC, a Kentucky Corporation; B'Laster Corporation, an Ohio Corporation; Castle Product, Inc., a New York Corporation; CRC Industries, Inc., a Pennsylvania Corporation; Exxon Mobil Corporation, a New Jersey Corporation; General Truck Sales Corporation, a West Virginia Corporation; Genuine Parts Company, D/B/A NAPA Auto Parts, a Georgia Corporation; Henkel Corporation, a Delaware Corporation; ITW Polymers Sealants North America, Inc., D/B/A ITW Pro Brands and or LPS, a Texas Corporation; Oliver Fuels & Oils, Inc., a West Virginia Corporation; Radiator Specialty Company, a North Carolina Corporation; Safety-Kleen Systems, Inc., a Wisconsin Corporation; Shamrock Specialties, Inc., a Texas Corporation; Walker Machinery, Co., a West Virginia Corporation; and ZEP, Inc., a Delaware Corporation, Defendant(s) In the Circuit Court of Putnam County, West Virginia. Honorable Judge Stowers (Supported Plaintiff)	Benzene Exposure	On-going	HAR-17-003 Case No.: 18-C83	2017-Present
Weitz & Luxenberg P.C. Ms. Robin Greenwald Mr. Jerry Kristoff 700 Broadway New York, NY 10003 Levin Papantonio Thomas Mitchell Rafferty & Proctor, P.A. 316 South Baylen Street Pensacola, FL 32502	Plaintiff(s): Chaplick, Kyle; Cole, Dean; Cook, Bryan; Gatewood, Stephen; Gatewood, Vicki; Haley, Richard; Hammond, Marcus; Jenkins, Lafayette; Karr, Joshua; Miller, Robert; Puchbauer, Michael; Sanders, Deion; Sessions, Joseph; Winston, Walter. Defendant(s): Monsanto Company In the Circuit Court of the City of St. Louis, State of Missouri (Supported Plaintiffs)	Exposure to Roundup Deposed 7/9, 10, & 11/2019 & 7/25-26/2019 Daubert Motion filed on 9/11/2019; – never ruled on.	Negotiated Settlement 06/2020	LEV-18-001 Case No.: 1822CC00515	2018-2020
R. Dean Hartley Hartley Law Group, PLLC The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff(s): Thomas E. Kemp, Jr. and Kelly Kemp, his wife Defendant(s): Sal Chemical Company, Inc. an Ohio Corporation; Superior Solvents, Inc. (Superior Oil Company, Inc.), d/b/a Superior Solvents and Chemicals, an Indiana corporation; The Valspar Corporation, a Delaware corporation; Karcher North America, Inc., d/b/a Hotsy, a Delaware corporation; Tier Environmental Services, Inc., as successor-in-interest to Hukill Chemical Corporation, a Delaware corporation; Jenkin-Guerin, Inc., a Missouri	Exposure to Chemicals Deposed on 1/23/2019	Negotiated Settlement 07/2019	HAR-18-002 Civil Action No.: 16-C-21	2018-2019

	corporation; ZEP Inc., as successor-in-interest to Selig Industries, a Delaware corporation; The Sherwin-Williams Company, an Ohio corporation; and Acuity Specialty Products, Inc. a Georgia corporation. In the Circuit Court of Brooke County, West Virginia. Honorable Ronald E. Wilson. (Supported Plaintiffs)				
R. Dean Hartley Hartley Law Group, PLLC The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff(s): Donald August Alexander and Fran Alexander, his Wife. Defendant(s): Koppers, Inc., a Pennsylvania Corporation; Southeast Ohio Auto Parts, Inc., d/b/a NAPA of Wellsburg, a Georgia Corporation; Kano Laboratories, Inc., a Tennessee Corporation; Sal Chemical Co., Inc., an Ohio Corporation; CRC Industries, Inc., a Pennsylvania Corporation; The B'Laster Corporation, an Ohio Corporation; and Safety-Kleen Systems, Inc., a Wisconsin Corporation. In the Circuit Court of Brooke County, West Virginia. (Supported Plaintiffs)	Exposure to Chemicals Deposed on 1/27/2021	On-Going	HAR-18-003 Civil Action No.: 16-C-35	2018-Present
R. Dean Hartley Hartley Law Group, PLLC The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff(s): Jay Bradford Crofford Defendant(s): Koppers, Inc., a Pennsylvania Corporation; Southeast Ohio Auto Parts, Inc., d/b/a NAPA of Wellsburg, a Georgia Corporation; Kano Laboratories, Inc., a Tennessee Corporation; Sal Chemical Co., Inc., an Ohio Corporation; CRC Industries, Inc., a Pennsylvania Corporation; The B'Laster Corporation, an Ohio Corporation; and Safety-Kleen Systems, Inc., a Wisconsin Corporation. In the Circuit Court of Brooke County, West Virginia (Supported Plaintiff)	Exposure to Chemicals	On-Going	HAR-18-004 Civil Action No.: 18-C-78	2018-Present
Metzger Law Group Raphael Metzger 401 E. Ocean Blvd., Ste. 800 Long Beach, CA 90802	Plaintiff(s): Johnny Nelson Blake and Kathleen Mary Blake Defendant(s): Akzo Nobel Coatings, Inc., as successor by acquisition to Devoe Coatings and Sinclair Paint Company, an Illinois Corporation; Benjamin Moore & Company, a New Jersey Corporation; Carboline Company, a Missouri Corporation; Castrol Industrial North America, Inc., a Texas Corporation; Dunn-Edwards Corporation, a California Corporation; Ellis Paint Company, a California Corporation; Ennis-Flint as successor by acquisition to Pervo Paint Company, a North Carolina Corporation; Illinois Tool Works, Inc., a Delaware Corporation; Jotun Paints, Inc., a Louisiana Corporation; Magnaflux Corporation, a Delaware Corporation; PPG Industries, Inc., as successor by acquisition to Ameron International Protective Coatings Group, a Pennsylvania Corporation; Rexnord Corporation, as successor by	Benzene Exposure	Negotiated Settlement 04/2019	MET-18-001 Case No.: BC616881; Honorable Terry A. Green, Dept. 14	2018-2019

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
	acquisition to the Falk Corporation, a Wisconsin Corporation; Rust-Oleum Corporation, an Illinois Corporation; Safety-Kleen Systems, Inc., a Massachusetts Corporation; The Steco Corporation, an Arizona Corporation; Pervo Paint Company, a California Corporation (previously sued herein as Doe #1); BASF Corporation, a Delaware Corporation (previously sued herein as Doe #2); PFI, Inc., a California Corporation (previously sued herein as Doe #3); PPG Industries, Inc. a Pennsylvania Corporation (previously sued herein as Doe #4); The Valspar Corporation, a Delaware Corporation (previously sued herein as Doe #5); The Sherwin-Williams, Company, an Ohio Corporation (previously sued herein as Doe #6); Tyco International (US), Inc., a Massachusetts Corporation (previously sued herein as Doe #7); W. M. Barr & Company, Inc. a Tennessee Corporation (previously sued herein as Doe #8); CRC Industries, Inc., a Pennsylvania Corporation (previously sued herein as Doe #9); 3M Company, a Delaware Corporation (previously sued herein as Doe #10); Aervoe Industries, Inc. a Nevada Corporation (previously sued herein as Doe #11); Krylon Products Group, an Ohio Corporation (previously sued herein as Doe #12); Axalta Coating Systems, LLC, as successor by acquisition to Pacific Coats Lacquer, a Delaware Limited Liability Company (previously sued herein as Doe #13); Seymour of Sycamore, Inc., an Illinois Corporation (previously sued herein as Doe #14); and Does 15-200, Inclusive. In the Superior Court of the State of California, County of Los Angeles, Central District (Supported Plaintiffs)				
Mr. Lon Walters The Walters Law Firm The City Market 23A East Third Street Kansas City, MO 64106	Plaintiff(s): Peggy Petrovic, Individually and as Plaintiff ad litem for Alexander Petrovic, Jr., deceased Defendant(s): BP Corporation North America Inc. and BP Products North America Inc. – Former American Oil Company (AMOCO) Site. Circuit Court of Jackson County, Missouri at Independence (Supported Plaintiffs)	Benzene Exposure Deposed on 3/13/2020	On-going	WAL-18-001 Cause No.: 1716-cv24363; Division 5	2018-Present
Mr. Jeff Gaddy Mr. Wesley Bowden Levin Papantonio 316 Baylen Street Pensacola, FL 32502	Plaintiff(s): Wayne D. McClung Defendant(s): E.I. du Pont de Nemours and Company Circuit Court of Wood County, West Virginia (Supported Plaintiff)	C-8 Exposure	Negotiated Settlement 03/2019	LEV-18-002 Civil Action No.: 17-C-223	2018-2019
Mr. Guy Bucci Mr. Scott Long Hendrickson & Long PLLC	Plaintiff(s): EQT Gathering, LLC Defendant(s): The Travelers Indemnity Company and	Gas Pipeline Explosion Wrongful Death	Negotiated Settlement 04/2019	HEN-18-001 Civil Action No.	2018-2019

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
214 Capitol St. Charleston, WV 25301	Travelers Casualty Company of America In the United States District Court for the Southern District of West Virginia at Charleston (Supported Plaintiff)			2:18-cv-00392	
Mr. John (Rett) Guerry III Motley Rice LLC 28 Brigeside Blvd. Mt. Pleasant, SC 29464	Plaintiff(s): Roach Defendant(s): CSX, Seaboard Coastline and Atlantic Coastline (Supported Plaintiff)	Diesel Fuel, Herbicides, Fungicides, Fertilizers, Spectracide, Pesticides and Organic Chemicals	Negotiated Settlement 01/2021	MOT-18-005	2018-2021
Mr. John (Rett) Guerry III Motley Rice LLC 28 Brigeside Blvd. Mt. Pleasant, SC 29464	Plaintiff(s): Logan Dodd Defendant(s): L&N/CSX Railroad (Supported Plaintiff)	Diesel Fuel & Exhaust/Benzene/ Asbestos	Negotiated Settlement 04/2021	MOT-18-004	2018-2021
Mr. John (Rett) Guerry III Motley Rice LLC 28 Brigeside Blvd. Mt. Pleasant, SC 29464	Plaintiff(s): Dale E. Price, Executor of the Estate of Gary E. Price, Deceased. Defendant(s): Consolidated Rail Corporation a/k/a American Premier Underwriters, Inc., Individually and as Successor-inInterest-or-Liability to Penn Central Transportation Company, and/or The Pennsylvania Railroad Company In the Court of Common Pleas of Allegheny County, PA – Civil Action – Asbestos (Supported Plaintiff)	Diesel Fuel, Diesel Exhaust, Creosote, and Asbestos	On-going	MOT-18-002 Case No.: GD 19-006889	2018-Present
Mr. John (Rett) Guerry III Motley Rice LLC 28 Brigeside Blvd. Mt. Pleasant, SC 29464	Plaintiff(s): Edward Arthur Johnson Defendant(s): CSX Transportation, Inc., Individually and as Successor-in-Interest to Louisville & Nashville Railroad Company and Seaboard Coast Line Railroad In the Circuit Court of Davidson, Tennessee (Supported Plaintiff)	Diesel Fuel & Exhaust/Benzene/ Asbestos	On-going	MOT-18-001 Case No. 19C105	2018-Present
J. Robert Black Black Law, PC 3701 Kirby Dr., Suite 101 Houston, TX 77098	Plaintiff(s): Eva Garcia Gonzales, Individually and as Personal Representative of the Estate of Ricardo S. Gonzales, deceased; Katherine G. Sanchez; Amanda Gonzales-Todd; and Joseph P. Gonzales. Defendant(s): Waukesha-Pearce, LLC; Ace Hardware Corporation; Berryman Products, Inc.; BP Amoco Chemical Company; BP Products North America, Inc.; BP Corporation North American, Inc.; Chevron, USA, Inc.; CRC Industries, Inc.; CTR Petroleum, Inc.; The Dow Chemical Company; E. I. DuPont De Nemours & Company; ExxonMobil Oil Corporation; Radiator Specialty Company; Safety-Kleen Corp., Safety-Kleen Systems, Inc.; Shell Oil, Co.; T[illegible]al	Benzene Exposure	Negotiated Settlement 05/2019	BLA-18-001 Case No: 2018-21475	2018-2019

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
	Petrochemicals & Refining USA, Inc.; Union Oil Company of California; United States Steel Corporation. In the District Court of Harris County, Texas, 281st Judicial District. (Supported Plaintiffs)				
Mr. John (Rett) Guerry III Motley Rice LLC 28 Brigeside Blvd. Mt. Pleasant, SC 29464	Plaintiff(s): James Ray Defendant(s): Kansas City Southern Railroad	Diesel Fuel & Exhaust/Benzene/ Asbestos	Negotiated Settlement 06/2021	MOT-19-002	2019-2021
R. Dean Hartley Hartley Law Group, PLLC The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff(s): Michael D. Ruble and Brenda K. Ruble, his wife. Defendant(s): Rust-Oleum Corporation; RPM International; Inc., Zinsser Company, Inc., individually and as successor-in –interest to New Parks, a New Jersey corporation; Zinsser Company, Inc., d/b/a New Parks, a division of Zinsser Company, Inc., a New Jersey corporation; New Parks, a division of Zinsser Company, Inc., a New Jersey corporation; E. I. DuPont de Nemours and Company; Akzo Nobel, Inc., f/k/a Akzo America, Inc., individually and as successor-ininterest to Akzo Nobel Functional Chemicals, LLC and Akzo Nobel Chemicals, Inc., a Delaware corporation; Akzo Nobel Functional Chemicals, LLC; Akzo Nobel Chemicals, Inc.; Bayer Corporation; Bayer CropScience; Monsanto Company; The Early Construction Company; Advansix, Inc.; Altiva Petrochemicals, LLC; Brenntag Great Lakes, LLC; Brenntag Great Lakes, LLC: Brenntag Mid-South, Inc.; Citgo Petroleum Corporation; Exxon Mobil Corporation; FBC Chemical Corporation; Matriz Chemical, LLC; Nexeo Solutions, LLC; the Yenkin-Majestic Paint Corporation; Special Materials Company; and Univar Solutions, Inc., individually and as successor-by-merger to Nexeo Solutions, LLC, a Delaware corporation. In the Circuit Court of Cabell County, West Virginia (Supported Plaintiffs)	Exposure to Chemicals	On-Going	HAR-19-001 Case No. 19-C-127	2019-Present
R. Dean Hartley Hartley Law Group, PLLC The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff(s): Mark Ady, Administrator of the Estate of Glenn R. Ady, Deceased Defendant(s): Shell Chemical LP, a Delaware limited partnership, d/b/a Shell Oil Company, et al. In the Circuit Court of Marshall County, West Virginia (Supported Plaintiff)	Formaldehyde Exposure	Negotiated Settlement 2019	HAR-19-003 Case No. 14-C-51K	2019

Weitz & Luxenberg P.C. Ms. Robin Greenwald Mr. Jerry Kristoff 700 Broadway	Plaintiff(s): Robert Dickey, Larry Domina, Royce Janzen, Yolanda Mendoza, Frank Pollard, John Sanders, & Frank Tanner	Exposure to Roundup Deposed 11/5 & 6/2019	Negotiated Settlement 06/2020	WL-19-001 Case No. 3:16-cv-05658-	2019-2020

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
New York, NY 10003 Levin Papantonio Thomas Mitchell Rafferty & Proctor, P.A. 316 South Baylen Street Pensacola, FL 32502	Defendant(s): Monsanto Company United States District Court, Northern District of California (Supported Plaintiffs)	Daubert Motion filed on 11/26/2019 – Decision moved to Local Federal Courts – Never Ruled On.		VC MDL No. 2741	
R. Dean Hartley Hartley Law Group, PLLC The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff(s): Lee Roy Rodgers Defendant(s): Chevron Mining, Inc., Successor by Merger of Molycorp, Inc. & Union Oil Company of California and Unocal Corporation; The B'Laster Corporation, BP Corporation North America, Inc.; and the Henkel Corporation. In Court of Common Pleas, Washington County, PA. (Supported Plaintiff)	Thorium, Uranium, and Benzene Exposures	Negotiated Settlement 02/2020	HAR-19-004 Case No.: 20161836	2019-2020

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
R. Dean Hartley Hartley Law Group, PLLC The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff(s): Mary Kay Virden, individually and as Executrix of the Estate of Charles E. Virden, deceased. Defendant(s): Covestro, LLC, as successor-in-interest to BayerMaterial Science, LLC a wholly owned affiliate of Bayer Corporation, which was formerly known as Miles, Inc., successor-in-interest to Mobay Corporation and Bayer U.S.A, a Pennsylvania limited liability company; Ashland LLC, a Kentucky limited liability company; Avantor, Inc., f/k/a Avantor Performance Materials d/b/a and successor to Mallinckrodt Baker, Inc., J.T. Baker, Inc., J.T. Baker Chemical Company, and VWR Corporation, a Delaware corporation; BP Amoco Chemical Company, as successor-in-interest to BP Chemicals, Inc., a Delaware Corporation; BP Products North America, Inc., successor-in-interest to BP Exploration & Oil, Inc., d/b/a BP Oil Company, a Maryland Corporation; Celanese Corporation, Successor-in Interest to Celanese AG, Hoechst Celanese Corporation and Celanese Chemicals, a Delaware Corporation; Chevron U.S.A., Inc., as successor-ininterest by merger to Union Oil Company of California and as successor-in-interest to UNOCAL Corp., a California Corporation; Exxon Mobil Corporation, a Delaware Corporation; Hess Corporation, f/k/a Hess Oil and Chemical Corporation, a New York corporation; Hexion Inc., formerly known as Momentive Specialty Chemicals, Inc., Successorin-Interest to Hexion Specialty Chemicals, Inc., a Bordon Chemical, Inc., and Borden, Inc., a New Jersey corporation; Shell Chemical, LP, d/b/a Shell Oil Company, a Delaware limited partnership; Sunoco (R&M), LLC, successor-ininterest to Sun Company, Inc. (R&M), a Pennsylvania limited liability company; Tauber Oil Company, a Texas Corporation; Texaco, Inc., a Delaware corporation; Thermo Fisher Scientific Inc., a successor-by-merger to Fisher Scientific International, Inc. successor to and f/k/a Fischer Scientific Company, a Delaware, Corporation; United States Steel Corporation, successor-in-interest to USX Corporation, USS chemicals Division, a Delaware Corporation; Valero RefiningTexas, L.P., as successor-in-interest by acquisition to Basis Petroleum, Inc., f/k/a Phibro Energy USA, Inc., a Delaware limited partnership. In the Circuit Court of Marshall County, West Virginia (Supported Plaintiff)	Exposure to Benzene and Benzene-Containing Chemicals	On-Going	HAR-19-005 Case No.: 19-C-252 C	2019-Present

J. Robert Black Black Law, PC 3701 Kirby Dr., Suite 101 Houston, TX 77098	Plaintiff(s): Aaron Augustine Defendant(s): DeBusk Services Group and Lubrizol. In the United States District Court Southern District of Texas Houston Division (Supported Plaintiff)	Chemical Burns to Feet and Ankles – Acrylonitrile Exposure	Negotiated Settlement 03/2020	BLA-19-003 Case No.: 4:19-cv-02157	2019-2020
Mr. John (Rett) Guerry III Motley Rice LLC 28 Brigeside Blvd. Mt. Pleasant, SC 29464	Plaintiff(s): Charles E. Caton, Jr., aka Charles Caton Defendant(s): CSX Transportation, Inc. (CSXT); c/o CT Corporation System Statutory Agent, 4400 Easton Commons Way, Suite 125, Columbus, OH 43219; and Consolidated Rail Corporation (CONRAIL); 1717 Arch Street, Suite 1310, Philadelphia, PA 19103-2844; and American Premier Underwriters, Inc. (APU), Individually and as Successor-ininterest to The Penn Central Transportation Company, c/o CT Corporation System Statutory Agent, 4400 Easton Commons Way, Suite 125, Columbus, OH 43219 Court of Common Pleas of Hamilton County, Ohio (Supported Plaintiffs)	Diesel Fuel & Exhaust/Benzene/ Asbestos	Negotiated Settlement 03/2020	MOT-19-003 Case No.: A1903216	2019-2020
Weitz & Luxenberg P.C. Ms. Robin Greenwald Mr. Jerry Kristoff 700 Broadway New York, NY 10003. Levin Papantonio Thomas Mitchell Rafferty & Proctor, P.A. 316 South Baylen Street Pensacola, FL 32502	Plaintiff(s): Timothy Kane et al. (Crabtree, Edwin; Dela Cruz, Thomas; Dyer, Angela; Haynes, Rosita; and Ramirez, Ron). Defendant(s): Monsanto Company In the Circuit Court of the City of St. Louis, State of Missouri. (Supported Plaintiffs)	Exposure to Roundup Deposed 12/3 & 4/2019	Negotiated Settlement 06/2020	WL-19-002 Case No. 1622-CC10172	2019-2020
Weitz & Luxenberg P.C. Ms. Robin Greenwald Mr. Jerry Kristoff 700 Broadway New York, NY 10003.	Plaintiff(s): Leroy Seitz, et al. (Cannon, Mario; Jenkins, Larry; Pinnon, Jerry; and Sorich, Scott). Defendant(s): Monsanto Company In the Circuit Court of the City of St. Louis, State of Missouri. (Supported Plaintiffs)	Exposure to Roundup Deposed 1/15 & 16/2020	Negotiated Settlement 06/2020	WL-19-003 Case No. 1722-CC11325	2019-2020

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
Levin Papantonio Thomas Mitchell Rafferty & Proctor, P.A. 316 South Baylen Street Pensacola, FL 32502					

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
Nadina Beach Lundy Soileau & South, LLP 501 Broad Street Lake Charles, Louisiana 70601	Plaintiff(s): LaTwon Whitby Defendant(s): Monsanto In the Circuit Court of the County of St. Louis, State of Missouri. (Supported Plaintiff)	Exposure to Roundup Deposed on 2/7/2020	Negotiated Settlement 06/2020	LUN-19-001 Case No.: 19SL-CC04020	2019-2020
Mr. Christopher Heavens 2438 Kanawha Blvd. East Charleston, WV 25311	Plaintiff(s): Justin Butcher and Jennifer Butcher Defendant(s): Halliburton Energy Services, Inc., a Delaware Corporation, Antero Resources Corporation, a Delaware Corporation, and Safety Management Systems, LLC, a Louisiana Corporation. In the United States District Court for the Northern District of West Virginia, Clarksburg. (Supported Plaintiff)	Work-related Amputation/Injury	On-going	HEA-19-001 Civil Action No. 1:20cv74 (Kleeh)	2019-Present
Mr. John E. Tomlinson Beasley, Allen, Crow, Methvin, Portis & Miles, P.C. 218 Commerce Street Montgomery, AL 36104	Plaintiff(s): Hollis D. Graham and Shirley Graham Defendant(s): 3M Company; American Offset Printing Ink; Anchor/Lith-Kem-Ko, Incorporated, a Subsidiary of FugiFilm Hunt Chemicals USA, Incorporated; FugiFilm Hunt Chemicals USA, Incorporated, d/b/a and Parent and Successor to Anchor/Lith-Kem-Ko, Incorporated; Day International, Inc.; Deleet Merchandising Corp.; Flint Group US, LLC; Fujifilm Hunt Chemicals USA, Inc.; Printer Service d/b/a Prisco; Rogersol, Inc., Rycoline Products, Inc., a Division of Sun Chemical Commercial Group a/k/a Rycoline Products, LLC and Successor to Rogersol, Inc.; Sun Chemical Corporation, Individually and a Parent and Successor to Rycoline Products, LLC, a/k/a Rycoline Products, Inc. and Successor to Rogersol, Inc.; Varn International, d/b/a Varn Products Company; Day International, Inc., Individually and as Successor to and d/b/a Varn Products Company. In the United States District Court, Northern District of Alabama, Southern Division (Supported Plaintiffs)	Exposure to Printing Products	Negotiated Settlement 12/2020	BEA-20-001 Case #: 2:18-cv-1362RDP.	2020
R. Dean Hartley Hartley Law Group, PLLC The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff(s): Frederick R. Eastman and Janet L. Eastman, his wife. Defendant(s): Sunoco, Inc.; Texaco, Inc.; Exxon Mobil Corp.; BP Amoco Chemical Company; BP Products North America, Inc.; 3-M Company; CRC Industries, Inc., Advanced Auto Parts, Inc. The B'Laster Corporation; Radiator Specialty	Exposure to Chemicals	On-going	HAR-20-001	2020-Present

	Company; United States Steel Corporation; Safety-Kleen Systems, Inc., Kano Laboratories; Valvoline, Inc.; RustOleum Corporation; The Testor Corp.; E.I. DuPont de Nemours & Company; The Sherwin-Williams Company; The Valspar Corporation; Autozone, Inc.; Pennzoil-Quaker State Company; W.M Barr & Company, Inc.; PPG Industries, Inc.; AGS Company Solutions, LLC; Sig Manufacturing Company, Inc.; Automotive Systems Warehouse, Inc.; Niteo Products, LLC; Illinois Tool Works, Inc.; Chase Products Company; Wilson Imperial Company; Zep, Inc. In the Court of Common Pleas of Allegheny County, Pennsylvania (Supported Plaintiffs)				
Mr. Kristofer Cormany Cormany Law, PLLC P.O. Box 11827 206 Capitol Street Charleston, WV 25339	Plaintiff(s): Lori Harrison, Administratrix of the Estate of Sarah Cain, Deceased. Defendant(s): Go-Mart, Inc., a West Virginia Corporation, and Heater Oil Company, Inc., a West Virginia Corporation. In the Circuit Court of Putnam County, West Virginia (Supported Plaintiff)	Exposure to Chemicals in Go-Mart Bathroom – Death of Women and Fetus	Negotiated Settlement February 2021	COR-20-001 Civil Action No.: 19-C-115	2020-2021
J. Robert Black Black Law, PC 3701 Kirby Dr., Suite 101 Houston, TX 77098	Plaintiff(s): James Crabtrey and Brenda Crabtrey Defendant(s): Atlantic Richfield Company; Bayer Corporation; Berryman Products, Inc.; Celanese Corporation; Chevron USA, Inc.; Covestro, LLC; Huntsman International, LLC; Ineos Styrolution America, LLC; Nova Chemicals, Inc.; Occidental Chemical Corporation; Radiator Specialty Company; Schneider Electric Systems USA, Inc.; Shell Oil Company; Total Petrochemicals & Refining USA, Inc.; Union Oil Company of California; United States Steel Corporation In the District Court Harris County, Texas (Supported Plaintiffs)	Chemical Exposure	On-Going	BLA-20-001 Cause No. 2020-05009 – Court 189	2020-Present
Mr. David P. Matthews Matthews & Associates 2905 Sackett Street Houston, TX 77098	Plaintiff(s): Randall Dean Seidl et al. Defendant(s): Monsanto Co. United States District Court, Northern District of California & In the Circuit Court of Jefferson County State of Missouri. (Supported Plaintiffs)	Exposure to Roundup	Non-resolved cases moved to Frazer, PLC	MAT-20-001 Case No.: 3:17cv-00519 MDL No. 2741 & Cause No.: 20JE-CO00709	2020-2021

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
William R. Sutton Beasley Allen Law Firm 218 Commerce St. Montgomery, AL 36104	Plaintiff(s): Randall Dean Seidl Defendant(s): Monsanto Co. United States District Court, Northern District of California (Supported Plaintiff)	Exposure to Roundup Deposed 3/2/2021	On-Going	BEA-20-2002 Case No.: 3:17cv-00519 MDL No. 2741	2020-Present
Mr. John (Rett) Guerry III Motley Rice LLC 28 Brigeside Blvd. Mt. Pleasant, SC 29464	Plaintiff(s): Cynthia Minnis, Personal Representative of the Estate of Porter K. Minnis, Deceased. Defendant(s): BNSF Railway Company, Individually and as Successor-in-Interest to The Burlington Northern, Inc., Burlington Northern & Santa Fe Railway Company, and Atchison, Topeka and Santa Fe Railway Company. In the Circuit Court of Linn County, State of Missouri (Supported Plaintiff)	Exposure to Diesel Fuel, Diesel Exhaust, Benzene, & Asbestos	On-Going	MOT-19-006 Civil Action No.: 19LI-CC00036	2021-Present
Mr. Wesley A. Bowden, Esq. Levin Papantonio Thomas Mitchell Rafferty & Proctor, P.A. 316 South Baylen Street Pensacola, FL 32502	In RE: Aqueous Film-Forming Foams Products Liability Litigation In the United States District Court for the District of South Carolina Charleston Division (Supported Plaintiff(s))	PFASs Expert Support	On-Going	LEV-21-002 MDL No.: 2:18mn-2873-RMG	2021-Present
Mr. Wesley A. Bowden, Esq. Levin Papantonio Thomas Mitchell Rafferty & Proctor, P.A. 316 South Baylen Street Pensacola, FL 32502	Plaintiff(s): Middlesex Water Company, New Jersey. Defendant(s): 3M Company. United States District Court for the District of New Jersey (Supported Plaintiff)	Evaluation of Treatment Methods and Costs for Removals of PFASs	On-Going	LEV-21-003 Case No.: 2:18cv-15366	2021-Present
R. Dean Hartley Hartley Law Group, PLLC The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff(s): Teddy A. Kemp and Judy L. Kemp, his wife. Defendant(s): Covestro, LLC, as successor-in-interest to BayerMaterial Science, LLC a wholly owned affiliate of Bayer Corporation, which was formerly known as Miles, Inc., successor-in-interest to Mobay Corporation and Bayer U.S.A, a Pennsylvania limited liability company; Axial Corporation, as successor-in-interest to PPG Industries, Inc., a Delaware Corporation; Ashland LLC, a Kentucky limited liability company; BP Amoco Chemical Company, as successor-ininterest to BP Chemicals, Inc., a Delaware Corporation; BP Products North America, Inc., successor-in-interest to BP Exploration & Oil, Inc., d/b/a BP Oil Company, a Maryland Corporation; Chevron U.S.A., Inc., as successor-in-interest by merger to Union Oil Company of California and as successor-in-interest to UNOCAL Corp., a California Corporation; Citgo Petroleum Corp., a Delaware Corporation; Conoco-Phillips Company, as successor by merger to Conoco, Inc. and f/k/a Phillips Petroleum Company, a Delaware Corporation; Exxon Mobil Corporation, a Delaware Corporation; Recochem, Inc., as successor-in-inte[illegible] to	Exposure to Benzene	Negotiated Settlement 04/12/2001	HAR-20-004 Civil Action No.: 19-C-113C	2020-2021

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
	Record Chemical Company, a Delaware Corporation; Shell Chemical, LP, d/b/a Shell Oil Company, a Delaware limited partnership; Sunoco (R&M), LLC, successor-in-interest to Sun Company, Inc. (R&M), a Pennsylvania limited liability company; Tauber Oil Company, a Texas Corporation; Union Oil Company of California, individually and as successor-ininterest by merger to UNOCAL Corp., a California Corporation; United States Steel Corporation, successor-ininterest to USX Corporation, USS chemicals Division, a Delaware Corporation; Valero Refining-Texas, L.P., as successor-in-interest by acquisition to Basis Petroleum, Inc., f/k/a Phibro Energy USA, Inc., a Delaware limited partnership; P&B Steel Erectors, Inc., a West Virginia Corporation; and Sistersville Tank Works, Inc., individually and successor-in-interest to Tyler County Tank Works, Inc. a West Virginia Corporation. In the Circuit Court of Marshall County, West Virginia (Supported Plaintiffs)				
R. Dean Hartley Hartley Law Group, PLLC The Wagner Building 2001 Main Street, Suite 600 Wheeling, WV 26003	Plaintiff(s): Gregory S. Gwinn and Kimberly Ann Gwinn, his wife Defendant(s): Axalta Coating Systems, LLC, a Delaware LLC; Beckley Welding Supply, Inc., a West Virginia Corporation; Crest Industries, Inc., a Michigan Corporation; E.I. DuPont de Nemours and Company, a Delaware Corporation; Fleetwood Products, Inc.; a New Jersey Corporation; Genuine Parts Company, d/b/a NAPA Auto Parts, a Georgia Corporation; Grow Automotive, a foreign entity; International Autobody Marketing Group (IAMG), an Arizona Corporation; Mountain Marketing, Inc., a West Virginia Corporation; PPG Industries, Inc., a Pennsylvania Corporation; Refinishing Material Specialties, Inc. d/b/a RMS Pro Finishes, Inc., individually and as successor-in-interest to Warren's Auto Parts, Inc., d/b/a Auto Body & Paint Supply, a West Virginia Corporation; Safety-Kleen Systems, Inc., a Wisconsin Corporation; The Sherwin-Williams Company (Martin Senour Automotive Finishes Division), an Ohio Corporation; Transtar Autobody Technologies, Inc., an Ohio Corporation; U-Pop US, Inc., a foreign entity; The Valspar Corporation, a Delaware Corporation; Warren's Auto Parts, Inc., d/b/a Auto Body & Paint Supply, a West Virginia Corporation; and William Farruggia, d/b/a B&L Distributors, a sole proprietorship. In the Circuit Court of Kanawha County, West Virginia. Honorable Judge Louis H. "Duke" Bloom (Supported Plaintiffs)	Exposure Surfactants and Surfactant Ingredients	On-going Deposed 4/13/2021, 4/14/2021 and 6/2/2021	HAR-20-005 Case No.: 17-C-622	2020-Present

ATTORNEY/LAW FIRM	CASE (Plaintiff(s) and Defendant(s) & Role	SUBJECT	DECISION	Project #/Case #	TIMEFRAME
Mr. Christopher Wiest Chris Wiest, Attorney at Law, PLLC 25 Town Center Blvd, Ste. 104 Crestview Hills, KY 41017	Plaintiff(s): Ridgeway Properties, LLC d/b/a Beans Café & Bakery and Commonwealth of Kentucky, ex re. Attorney General Daniel Cameron Defendant(s): Hon. Andrew Beshear, Governor, Commonwealth of Kentucky, et al. Commonwealth of Kentucky Boone County Court, Division 1 (Supported Plaintiffs)	COVID – Lockdowns, Masks and PPE	Trial Testimony on May 17, 2021 Bench Trial Decision in Favor of Plaintiffs on 6/8/2021	WEI-21-001 Case No.: 20-CI-00678	2021-2021
Mr. Seldon Jeff Childers Childers Law, LLC 2135 NW 40th Terrace, Suite B Gainesville, Florida 32605	Plaintiff: Justin Green Defendant(s): Alachua County, a political subdivision of the State of Florida In the Circuit Court of the Eighth Judicial Circuit in and for Alachua County, Florida & First District Court of Appeal State of Florida (Supported Plaintiff)	COVID – Lockdowns, Masks and PPE	Disclosed 4/21/2021 Appellant Decision in Favor of Plaintiffs for Reversal and Remanding 6/11/2021	WEI-21-001 Case No.: 2020-CA-1249	2021-2021

Mr. Patrick D. McMurtray Frazer PLC Burton Hills II 30 Burton Hills Blvd., Suite 450 Nashville, TN 37215	Plaintiff(s): Dolores Verdier, et al. Defendant(s): Monsanto Company, et al. In the Circuit Court of Jefferson County State of Missouri. (Supported Plaintiffs)	Exposure to Roundup	On-Going	FRA-21-001 Cause No.: 20JE-CO00709	2021-Present
Mr. John (Rett) Guerry III Motley Rice LLC 28 Brigeside Blvd. Mt. Pleasant, SC 29464	Plaintiff(s): Carolyn L. Robinson, as Executrix of the Estate of Jesse Irvin Robinson, Deceased and Wrongful Death Beneficiary and Surviving Spouse. Defendant(s): Illinois Central Railway Company. In the Circuit Court of the 19th Judicial District of Jackson County, Mississippi. (Supporting Plaintiff)	Exposure to Diesel Fuel, Diesel Exhaust, Herbicide, Solvents, & Asbestos	On-Going	MOT-21-001 Civic Action: 21-28(3)	2021-Present

Exhibit iii

Centers for Disease Control and Prevention

COVID-19

Scientific Brief: SARS-CoV-2 Transmission

Updated May 7, 2021

Summary of recent changes

Updates as of May 7, 2021

- This science brief has been updated to reflect current knowledge about SARS-CoV-2 transmission and reformatted to be more concise.
- Modes of SARS-CoV-2 transmission are now categorized as inhalation of virus, deposition of virus on exposed mucous membranes, and touching mucous membranes with soiled hands contaminated with virus.
- Although how we understand transmission occurs has shifted, the ways to prevent infection with this vir have not. All prevention measures that CDC recommends remain effective for these forms of transmissi

SARS-CoV-2 is transmitted by exposure to infectious respiratory fluids

The principal mode by which people are infected with SARS-CoV-2 (the virus that causes COVID-19) is througl exposure to respiratory fluids carrying infectious virus. Exposure occurs in three principal ways: (1) inhalatio fine respiratory droplets and aerosol particles, (2) deposition of respiratory droplets and particles on expose mucous membranes in the mouth, nose, or eye by direct splashes and sprays, and (3) touching mucous mem with hands that have been soiled either directly by virus-containing respiratory fluids or indirectly by touchir surfaces with virus on them.

People release respiratory fluids during exhalation (e.g., quiet breathing, speaking, singing, exercise, coughing, sı in the form of droplets across a spectrum of sizes.[1-9] These droplets carry virus and transmit infection.

- The largest droplets settle out of the air rapidly, within seconds to minutes.
- The smallest very fine droplets, and aerosol particles formed when these fine droplets rapidly dry, are smal

Exhibit iii

that they can remain suspended in the air for minutes to hours.

Infectious exposures to respiratory fluids carrying SARS-CoV-2 occur in three principal ways (not mutually exclus

1. **Inhalation** of air carrying very small fine droplets and aerosol particles that contain infectious virus. Risk of transmission is greatest within three to six feet of an infectious source where the concentration of these ve droplets and particles is greatest.
2. **Deposition** of virus carried in exhaled droplets and particles onto exposed mucous membranes (i.e., "splas sprays", such as being coughed on). Risk of transmission is likewise greatest close to an infectious source w concentration of these exhaled droplets and particles is greatest.
3. **Touching** mucous membranes with hands soiled by exhaled respiratory fluids containing virus or from tou inanimate surfaces contaminated with virus.

The risk of SARS-CoV-2 infection varies according to the amount of virus to which a person is exposed

Once infectious droplets and particles are exhaled, they move outward from the source. The risk for infection de with increasing distance from the source and increasing time after exhalation. Two principal processes determin amount of virus to which a person is exposed in the air or by touching a surface contaminated by virus:

1. **Decreasing concentration of virus in the air** as larger and heavier respiratory droplets containing virus fall ground or other surfaces under the force of gravity and the very fine droplets and aerosol particles that ren the airstream progressively mix with, and become diluted within, the growing volume and streams of air th encounter. This mixing is not necessarily uniform and can be influenced by thermal layering and initial jetti exhalations.
2. **Progressive loss of viral viability and infectiousness** over time influenced by environmental factors such a temperature, humidity, and ultraviolet radiation (e.g., sunlight).

Transmission of SARS-CoV-2 from inhalation of virus in air farther than six feet from an infectious source can oc

With increasing distance from the source, the role of inhalation likewise increases. Although infections through i at distances greater than six feet from an infectious source are less likely than at closer distances, the phenomer been repeatedly documented under certain preventable circumstances.[10-21] These transmission events have inv presence of an infectious person exhaling virus indoors for an extended time (more than 15 minutes and in som hours) leading to virus concentrations in the air space sufficient to transmit infections to people more than 6 fee and in some cases to people who have passed through that space soon after the infectious person left. Per publ reports, factors that increase the risk of SARS-CoV-2 infection under these circumstances include:

- **Enclosed spaces with inadequate ventilation or air handling** within which the concentration of exhaled re fluids, especially very fine droplets and aerosol particles, can build-up in the air space.
- **Increased exhalation** of respiratory fluids if the infectious person is engaged in physical exertion or raises t voice (e.g., exercising, shouting, singing).

Prolonged exposure to these conditions, typically more than 15 minutes.

Prevention of COVID-19 transmission

The infectious dose of SARS-CoV-2 needed to transmit infection has not been established. Current evidence stro suggests transmission from contaminated surfaces does not contribute substantially to new infections. Althougl studies[22-24] and epidemiologic investigations[25] (in addition to those described above) indicate that inhalation of v cause infection, the relative contributions of inhalation of virus and deposition of virus on mucous membranes r unquantified and will be difficult to establish. Despite these knowledge gaps, the available evidence continues to demonstrate that existing recommendations to prevent SARS-CoV-2 transmission remain effective. These includ distancing, community use of well-fitting masks (e.g., barrier face coverings, procedure/surgical masks), adequat ventilation, and avoidance of crowded indoor spaces. These methods will reduce transmission both from inhalat virus and deposition of virus on exposed mucous membranes. Transmission through soiled hands and surfaces prevented by practicing good hand hygiene and by environmental cleaning.

References

1. Stadnytskyi V, Bax CE, Bax A, Anfinrud P. The airborne lifetime of small speech droplets and their potential importance in SARS-CoV-2 transmission. *Proc Natl Acad Sci U S A*. Jun 2 2020;117(22):11875-11877. doi:10.1073/pnas.2006874117
2. Alsved M, Matamis A, Bohlin R, et al. Exhaled respiratory particles during singing and talking. *Aerosol Scienc Technology*. 2020;54(11):1245-1248. doi:10.1080/02786826.2020.1812502
3. Echternach M, Gantner S, Peters G, et al. Impulse Dispersion of Aerosols during Singing and Speaking: A Pot COVID-19 Transmission Pathway. *Am J Respir Crit Care Med*. Dec 1 2020;202(11):1584-1587. doi:10.1164/rccm.202009-3438LE
4. Asadi S, Wexler AS, Cappa CD, Barreda S, Bouvier NM, Ristenpart WD. Aerosol emission and superemission human speech increase with voice loudness. *Sci Rep*. Feb 20 2019;9(1):2348. doi:10.1038/s41598-019-38808
5. Asadi S, Wexler AS, Cappa CD, Barreda S, Bouvier NM, Ristenpart WD. Effect of voicing and articulation man aerosol particle emission during human speech. *PLoS One*. 2020;15(1):e0227699. doi:10.1371/journal.pone.
6. Morawska L., Johnson GR, Ristovski ZD, et al. Size distribution and sites of origin of droplets expelled from t human respiratory tract during expiratory activities. *Aerosol Sci*. 2009;40(3):256-269.
7. Buonanno G, Stabile L, Morawska L. Estimation of airborne viral emission: Quanta emission rate of SARS-Co infection risk assessment. *Environment international*. May 11 2020;141:105794. doi:https://dx.doi.org/10.10 /j.envint.2020.105794
8. Papineni RS, Rosenthal FS. The size distribution of droplets in the exhaled breath of healthy human subject: *Aerosol Med*. Summer 1997;10(2):105-16. doi:10.1089/jam.1997.10.105
9. Edwards DA, Ausiello D, Salzman J, et al. Exhaled aerosol increases with COVID-19 infection, age, and obesit *Natl Acad Sci U S A*. Feb 23 2021;118(8)doi:10.1073/pnas.2021830118
10. Bae S, Kim H, Jung TY, et al. Epidemiological Characteristics of COVID-19 Outbreak at Fitness Centers in Che Korea. *J Korean Med Sci*. Aug 10 2020;35(31):e288. doi:10.3346/jkms.2020.35.e288
11. Brlek A, Vidovic S, Vuzem S, Turk K, Simonovic Z. Possible indirect transmission of COVID-19 at a squash cou Slovenia, March 2020: case report. *Epidemiol Infect*. Jun 19 2020;148:e120. doi:10.1017/S095026882000132
12. Cai J, Sun W, Huang J, Gamber M, Wu J, He G. Indirect Virus Transmission in Cluster of COVID-19 Cases, Wen

China, 2020. *Emerging infectious diseases*. Mar 12 2020;26(6):12. doi:https://dx.doi.org/10.3201/eid2606.20

13. Shen Y, Li C, Dong H, et al. Community Outbreak Investigation of SARS-CoV-2 Transmission Among Bus Ride Eastern China. *JAMA Intern Med*. Dec 1 2020;180(12):1665-1671. doi:10.1001/jamainternmed.2020.5225
14. Groves LM, Usagawa L, Elm J, et al. Community Transmission of SARS-CoV-2 at Three Fitness Facilities — Ha June–July 2020. *MMWR Morb Mortal Wkly Rep*. Feb 24 2021;70(Early Release)
15. Hamner L, Dubbel P, Capron I, et al. High SARS-CoV-2 Attack Rate Following Exposure at a Choir Practice – S County, Washington, March 2020. *MMWR Morb Mortal Wkly Rep*. May 15 2020;69(19):606-610. doi:10.15585/mmwr.mm6919e6
16. Jang S, Han SH, Rhee JY. Cluster of Coronavirus Disease Associated with Fitness Dance Classes, South Korea *Infect Dis*. Aug 2020;26(8):1917-1920. doi:10.3201/eid2608.200633
17. Lendacki FR, Teran RA, Gretsch S, Fricchione MJ, Kerins JL. COVID-19 Outbreak Among Attendees of an Exer Facility — Chicago, Illinois, August–September 2020. *MMWR Morb Mortal Wkly Rep*. Feb 24 2021;70(Early Re
18. Li Y, Qian H, Hang J, et al. Probable airborne transmission of SARS-CoV-2 in a poorly ventilated restaurant. *B Environ*. Jun 2021;196:107788. doi:10.1016/j.buildenv.2021.107788
19. Lu J, Gu J, Li K, et al. COVID-19 Outbreak Associated with Air Conditioning in Restaurant, Guangzhou, China, *Emerging infectious diseases*. Apr 2 2020;26(7)doi:10.3201/eid2607.200764
20. Katelaris AL, Wells J, Clark P, et al. Epidemiologic Evidence for Airborne Transmission of SARS-CoV-2 during (Singing, Australia, 2020. *Emerg Infect Dis*. Apr 5 2021;27(6)doi:10.3201/eid2706.210465
21. Charlotte N. High Rate of SARS-CoV-2 Transmission Due to Choir Practice in France at the Beginning of the (Pandemic. *J Voice*. Dec 23 2020;doi:10.1016/j.jvoice.2020.11.029
22. Shi J, Wen Z, Zhong G, et al. Susceptibility of ferrets, cats, dogs, and other domesticated animals to SARS–co 2. *Science*. 2020:eabb7015. doi:10.1126/science.abb7015
23. Kim YI, Kim SG, Kim SM, et al. Infection and Rapid Transmission of SARS-CoV-2 in Ferrets. *Cell host & microb* 2020;doi:10.1016/j.chom.2020.03.023
24. Kutter JS, de Meulder D, Bestebroer TM, et al. SARS-CoV and SARS-CoV-2 are transmitted through the air be ferrets over more than one meter distance. *Nat Commun*. Mar 12 2021;12(1):1653. doi:10.1038/s41467-021
25. Klompas M, Baker MA, Rhee C, et al. A SARS-CoV-2 Cluster in an Acute Care Hospital. *Ann Intern Med*. Feb 9 2021;doi:10.7326/M20-7567

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Exhibit iv

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Isolation of SARS-CoV-2 from the air in a car driven by a COVID patient with mild illness

John A. Lednicky[a,b], Michael Lauzardo[a,c], Md. M. Alam[a,b], Maha A. Elbadry[a,b], Caroline J. Stephenson[a,b], Julia C. Gibson[a,b], J. Glenn Morris Jr.[a,c,*]

[a] *Emerging Pathogens Institute, University of Florida, Gainesville, FL, United States*
[b] *Department of Environmental and Global Health, College of Public Health and Health Professions, University of Florida, Gainesville, FL, United States*
[c] *Department of Medicine, College of Medicine, University of Florida, Gainesville, FL, United States*

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ABSTRACT

Objective: To determine if viable virus could be isolated from the air within a car driven by a patient infected with SARS-CoV-2, and to assess the size range of the infectious particles.
Methods: We used a Sioutas personal cascade impactor sampler (PCIS) to screen for SARS-CoV-2 in a car driven by a COVID-19 patient. The patient, who had only mild illness without fever or cough and was not wearing a mask, drove the car for 15 min with the air conditioning turned on and windows closed. The PCIS was clipped to the sun-visor above the front passenger seat and was retrieved from the car two hours after completion of the drive.
Results: SARS-CoV-2 was detectable at all PCIS stages by PCR and was cultured from the section of the sampler collecting particles in the 0.25–0.50 μm size range.
Conclusions: Our data highlight the potential risk of SARS-CoV-2 transmission by minimally symptomatic persons in the closed space inside of a car and suggest that a substantial component of that risk is via aerosolized virus.

Introduction

While we have learned a great deal about transmission of SARS-CoV-2 since the beginning of the current pandemic, questions remain about the exposure risk in different settings, and the contribution of various modes of transmission to virus spread (Lee et al., 2020; Somsen et al., 2020; WHO, 2020; CDC, 2020a). In particular, there is continuing uncertainty about the relative contribution of larger virus-laden respiratory particles at close distances, compared with virions in aerosols at close or longer ranges, to spread of the virus. There are now multiple epidemiology studies consistent with aerosol spread of SARS-CoV-2 within closed spaces (Park et al., 2020; Hamner et al., 2020) and the virus has been shown to remain infective in laboratory-generated aerosols for at least 16 h (Fears et al., 2020). Data from our group and others have documented the presence of the virus in aerosols in patient settings by RT-PCR (Rahmani et al., 2020; Lednicky et al., 2020a; Santarpia et al., 2020). However, molecular detection of SARS-CoV-2 RNA does not necessarily correlate with risk of developing COVID-19, since only viable virions can cause disease. Subsequently, we have reported isolation of viable SARS-CoV-2 from the air within the room of hospitalized COVID-19 patients (Lednicky et al., 2020b).

The current study was undertaken to assess SARS-CoV-2 transmission in a "real life" setting, outside of a medical facility. In epidemiologic studies, public transportation vehicles have been identified as a risk factor for transmission by CDC (2020b), and studies from Singapore have reported an odds ratio for infection of 3.07 [95% CI 1.55–6.08] for persons sharing a vehicle with an infected person (Ng et al., 2021). In this setting, we were interested in documenting that viable virus could be isolated from the air of a car being driven by a person infected with SARS-CoV-2. We were also interested in determining the size distribution of airborne respiratory secretions that contain virions to provide some guide to the contribution of droplets and aerosols to transmission risk. To address these questions, we asked a COVID patient with minimal symptoms to drive her car for a short period of time with a Sioutas personal cascade impactor sampler (PCIS) (Misra et al., 2002; Lednicky and Loeb, 2013) clipped onto the sun-visor above the passenger seat next to her, to permit collection of air samples for screening for the virus.

* Corresponding author at: Emerging Pathogens Institute, University of Florida, 2055 Mowry Road, Gainesville, FL 32610, United States.
E-mail address: jgmorris@epi.ufl.edu (J. G. Morris).

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Exhibit iv

Methods

Instrumentation

The Sioutas Personal Cascade impactor sampler (PCIS) separates airborne particles in a cascading fashion and simultaneously collects the size-fractionated particles by impaction on polytetrafluoroethylene (PTFE) filters) (Misra et al., 2002; Lednicky and Loeb, 2013). It has collection filters on four impaction stages (A–D), and an optional after-filter can be added onto a 5th stage (E). The PCIS separates and collects airborne particulate matter above the cut-point of five size ranges: >2.5 μm (Stage A), 1.0–2.5 μm (Stage B), 0.50–1.0 μm (Stage C), 0.25–0.50 μm (Stage D), and <0.25 μm (collected on an after-filter) (Figure 1). PTFE filters (Teflon filters) can collect particles at high efficiency above the cut-points without the need for coatings (Misra et al., 2002), which is advantageous as various coatings reduce the recovery efficiency of viable virus. For the collection of airborne viruses, the filters are not pre-wetted with methanol prior to use, which helps preserve virus viability (Fabian et al., 2009). For the current study, a PCIS (SKC, Inc., catalog number 225-370) unit was used with a Leland Legacy pump (SKC, Inc., cat number 100-3002) and operated at a flow rate of 9 L/min. PTFE filters (25 mm, 0.5 μm pore, SKC, Inc. catalog number 225-2708) were used for the collection stages A–D, and a PTFE after-filter (37 mm, 2.0 μm pore, SKC Inc., catalog number 225-1709) for stage E. The pump's operating flow rate (9 L/min) was calibrated by measuring volume displacement using a Defender Primary Standard Calibrator (SKC, Inc., catalog number 717-510H).

Laboratory studies

Within 30 min of the termination of air-sampling, the PCIS filters were individually immersed in 1 mL of recovery solution (PBS with 0.5% w/v BSA fraction V and 0.2 M sucrose)[11] for 30 min at room temperature to help rehydrate and dislodge virions stuck on the filter surfaces. The filters and fluid were then transferred to a sterile plastic petri dish, and the filters scraped with flocked swabs pre-wetted with recovery solution and residual fluid in each swab extruded into the liquid corresponding to each filter. The recovery solutions were concentrated by centrifugation in Amicon Ultra-15 centrifugal filter units with Ultracel-100 membranes with a molecular mass cutoff of 100 kDa (Millipore, Bedford, MA) at 4000 × g for 12 min to a volume of approximately <400 μL, and the concentrates adjusted to 400 μL by addition of recovery solution. They were then aseptically transferred to sterile plastic cryotubes with O-ring seals, and the tubes stored in a locked −80 °C freezer for subsequent analyses.

After one thaw on ice, RNA was extracted from 140 μL of material extruded off the PCIS filters using a QIAamp Viral RNA Mini Kit and the purified bound RNA eluted from the RNA-binding silicon columns in a volume of 80 μL. rRT-PCR was subsequently used to detect SARS-CoV-2 RNA and was performed using primer system Led-N-F, Led-N-R, and Led-N-probe.[11] Briefly, vRNA was denatured for 5 min at 67 °C in the presence of SUPERase-In RNase inhibitor (Invitrogen Corp.), cooled rapidly, and 25 μL rtRT-PCR performed in a BioRad CFX96 Touch Real-Time PCR Detection System using 5 μL of purified vRNA using the following parameters: 400 nM final concentration of forward and reverse primers and 100 nM final concentration of probe using SuperScript™ III One-Step RT-PCR system with Platinum™ Taq DNA Polymerase (Thermo Fisher Scientific). Cycling conditions were 20 min at 50 °C for reverse transcription step, followed by 2 min at 95 °C for Taq polymerase activation step, then 44 cycles of 15 s at 95 °C of denaturing, 30 s at 57 °C for annealing, and 20 s at 68 °C for extension (Lednicky et al., 2020b). The number of viral genome equivalents present in each sample was estimated from the measured quantification cycle (Cq) values, and was attained by using 10-fold dilutions of calibrated plasmids containing an insert of the SARS-CoV-2 N-gene as previously described (Lednicky et al., 2020b).

Attempts to isolate SARS-CoV-2 were performed in a BSL3 laboratory by trained analysts wearing full head-covering powered air purifying respirators and appropriate PPE. After one thaw on ice,

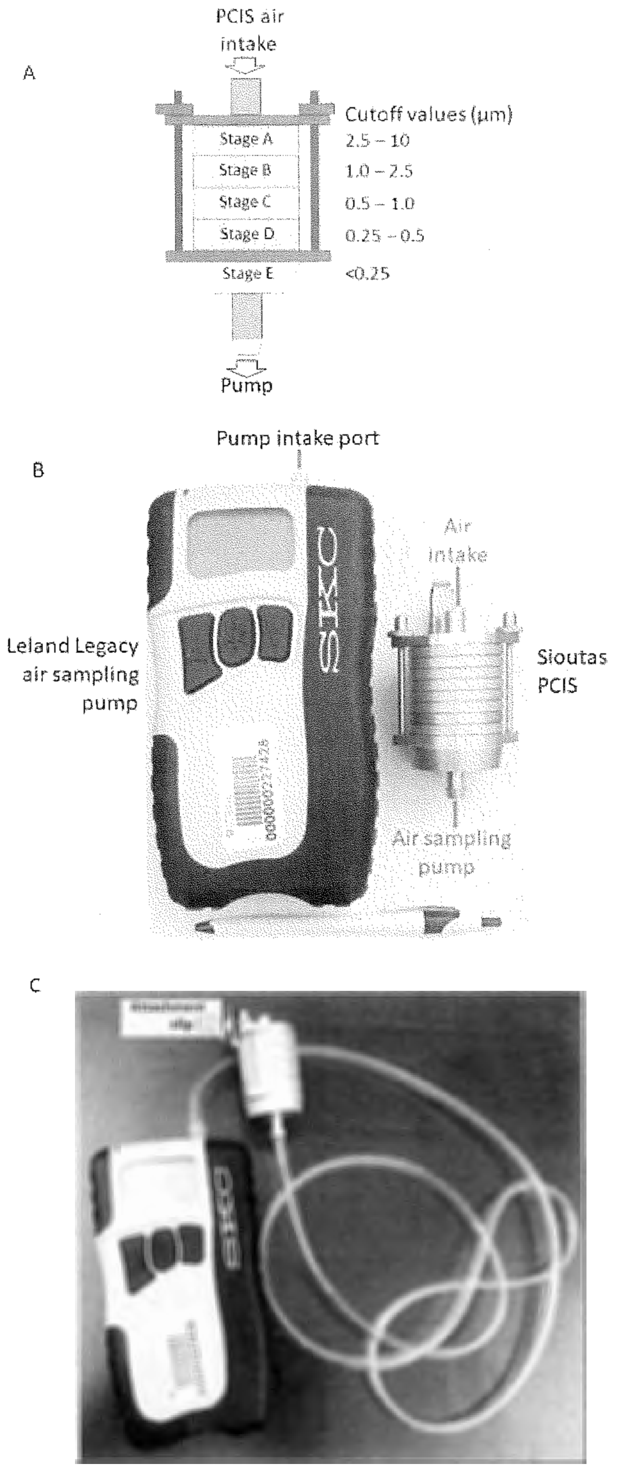

Figure 1. Sioutas Personal Cascade Impactor Sampler (PCIS). (A) Schematic representation of the five stages of a PCIS. (b) Photograph of an SKC Leland Legacy air sampler pump and a PCIS unit. A pen is shown below the pump and PCIS unit to provide size perspective. (c) Attachment clip in PCIS and SKC Leland Legacy air sampler pump assembly.

150 μL aliquots of PCIS fluids were inoculated onto newly confluent Vero E6 cells, which were then incubated at 37 °C in a humidified 5% CO_2 incubator. Mock infected cells were maintained in parallel. The cells were re-fed with cell growth medium containing reduced serum (3% fetal bovine serum) every three days (Lednicky et al., 2020b). Sanger sequencing was performed on RNA extracted from the cell growth medium. As a secondary check, NGS was also performed using an Illumina MiSeq platform, as previously described (Lednicky et al., 2020b). The sequencing reactions were performed at different locations by different personnel.

Ethics statement

Verbal consent for sample collection was obtained from the driver of the car. The work was reviewed and approved by the University of Florida IRB.

Results

The patient, who was in her twenties, had initially presented to clinic with a one-day history of mild fatigue, nasal congestion, and sore throat, following exposure to a roommate who had a laboratory-confirmed diagnosis of COVID-19. The patient denied fever, cough, shortness of breath, or other symptoms, and had a normal physical exam. In testing performed by the UFHealth clinical laboratory, a nasopharyngeal swab collected at the time of presentation was positive by RT-PCR. The patient was advised to isolate at home for a 10-day period of time, and appropriate contact tracing was initiated.

Two days after the diagnostic sample was obtained, the patient agreed to have the PCIS placed in her car (an older model Honda Accord) for the drive from the clinic to her home. Her symptoms at that time were minimal, with no cough. The PCIS was attached to the sun-visor on the passenger side of the car, approximately 3 feet from the patient's face and with the intake port pointing toward the roof of the car, with the pump assembly placed on the front passenger seat. During the 15-min drive the patient was not wearing a mask. The air conditioner in the car was on and windows were closed; during the drive the temperature within the car's cabin ranged from 24.2 to 22.8 °C and relative humidity fluctuated from 42.5% to 55.2%; outside temperature was 32 °C and relative humidity 99%.

Two hours after the patient's arrival home, an investigator wearing personal protective equipment (N95 mask, gloves, and a Tyvek laboratory coat) opened the car and turned off the pump of the air sampler, and transferred the PCIS-pump assembly into a sealed container and decontaminated the outer surface of the container. A total collection time of 135 min was thus used to sample approximately 1.22 m^3 of air within the vehicle.

SARS-CoV-2 RNA was detected on filters A–D, suggesting that the PCIS had collected a range of particle sizes containing SARS-CoV-2 virions or other material (possibly cell debris) containing SARS-CoV-2 RNA (Table 1). More of the SARS-CoV-2 RNA material was collected on filter D than that on filters A–C and E combined.

Filter material was subsequently inoculated onto Vero E6 cells (Lednicky et al., 2020a). Early cytopathic effects consistent with those caused by SARS-CoV-2 were observable by 3 days in cells inoculated with material collected onto PCIS filter D; by day 5, foci of infection were apparent for cells inoculated with material from filter D (Figure 2 and D), with no signs of virus infection in cells inoculated with material collected by PCIS filters B, C, and E. The mock-infected cell monolayer remained intact (Figure 2A), fungus overgrowth was evident in cells inoculated with material from PCIS filter A (Figure 2B), and rRT-PCR tests indicated that SARS-CoV-2 had indeed been isolated. For further confirmation, an aliquot (20 μL) of the virus collected 5 days post inoculation of material from filter D was passaged in Vero E6 cells, wherein an rRT-PCR Cq value of 12.46 was attained 3 days post-inoculation of the cells.

Sanger sequencing was performed on RNA extracted from the cell growth medium corresponding to PCID filter D (Table 2); as a secondary check, NGS was also performed using an Illumina MiSeq platform (Lednicky et al., 2020a). Sequencing reactions were performed at different locations by different personnel. The virus isolated was designated as SARS-CoV-2/human/USA/UF-29/2020 (GenBank no. MW229264.1). SARS-CoV-2 UF-29 has the following marker variants relative to reference strain Wuhan-Hu-1 (GenBank no. NC_045512.2): C241T, C3037T, A23403G, G25563T, Spike protein D614G, and ORF3a protein Q57H. These markers identify it as a member of clade GH following Global Initiative on Sharing All Influenza Data (GISAID) clade nomenclature (GISAID 2020; Mercatelli & Giorgi 2020).

Discussion

The air we breathe typically contains airborne particles of biological origin, including bacteria (cells and spores), fungi (mycelia and spores), and virions. Respiratory pathogens that are able to remain viable after aerosolization and air transport are potential causes of respiratory diseases, and they are often associated with other substances to form 'complex particles' (Tang 2009; Pan et al., 2019; Verreault et al., 2008). It should be noted that scanning electron microscopy of human specimens that contain SARS-CoV-2 often depicts clumps of virions and virions attached in a "beads on a string" manner (example: see https://www.flickr.com/photos/54591706@N02/49557785797). Therefore, it is plausible that humans release different forms of the virus (clumped, single particle, etc.), which affects how the virions are partitioned in different-sized airborne respiratory secretions. Our detection of vRNA in stages A–D of the impactor is consistent with the hypothesis that virions are present in different sized respiratory secretions. Remarkably, viable virus was only detected in stage D, corresponding to collection of airborne particles of the size range of 0.25–0.5 μm. The PCIS is a cascade impactor, and the manner that virus particles are collected (impaction onto filters) and the presence of a constant air-flow stream (drying out the virus) should, if anything, have reduced virus viability. The air flow

Table 1
rRT-PCR detection of SARS-CoV-2 RNA on filters.

Sample	PCIS size cut-off value (μm)	Cq	Genome eq. 25 μL rRT-PCR reaction[a]	Genome eq. per 1.0 m^3 of air
PCIS filter A	2.5–10.0	36.66	3.77E+01	1.24E+03
PCIS filter B	1.0–2.5	35.23	1.19E+02	3.90E+03
PCIS filter C	0.5–1.0	34.37	2.37E+02	7.77E+03
PCIS filter D	0.25–0.5	33.50	4.79E+02	3.14E+04
PCIS filter E	<0.25	40.1	(equivocal)	0
+ Control	Not applicable	26.85	1.00E+05	Not applicable
– Control	Not applicable	0	0	Not applicable

Standard curve: SYBR, E = 123.4%, R^2 = 1, slope = –2.865, Y int = 41.173.
[a] Equivalent to RNA in 10 μL out of a total resuspension volume of 400 μL/filter.

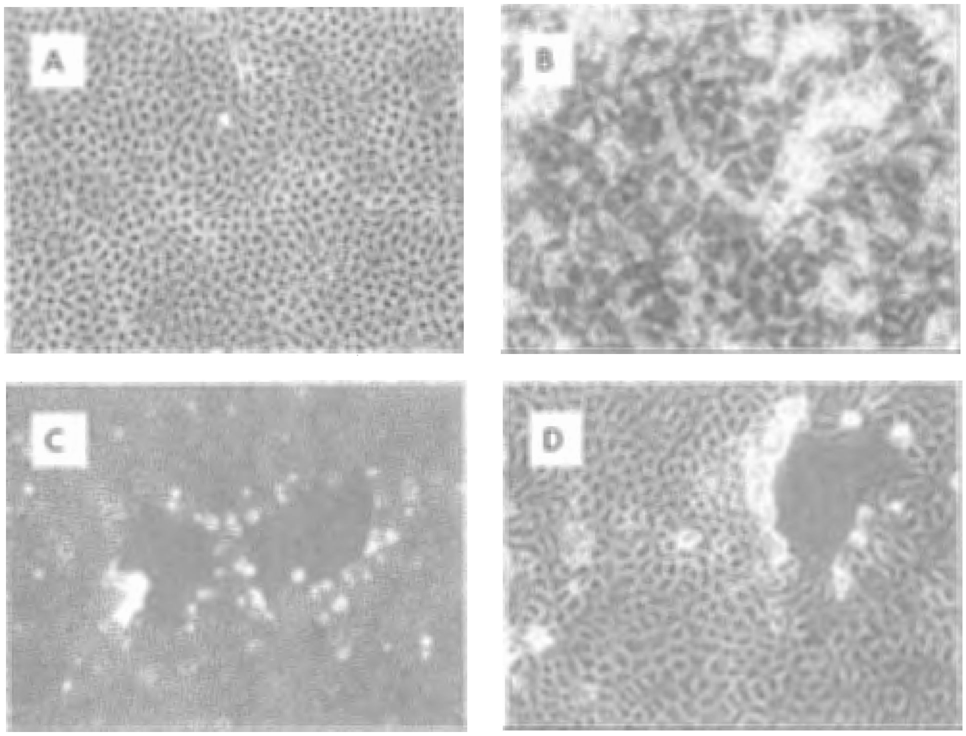

Figure 2. Isolation of SARS-CoV-2 five days post-inoculation of Vero E6 cells. [A] Mock-infected Vero E6 cells. [B] Cells inoculated with material from PCIS filter A. [C] and [D] Cells inoculated with material from PCIS filter D. Images A, B, and D were photographed at an original magnification of 200×, whereas image C was photographed at 100×.

Table 2
rRT-PCR tests 5 days post-inoculation of Vero E6 cells.

Sample	Cq	Notes
PCIS filter A	0	Fungus contamination
PCIS filter B	0	No virus isolated
PCIS filter C	0	No virus isolated
PCIS filter D	29.65	Virus isolated
PCIS filter E	0	No virus isolated
+ Control	14.23	Virus isolated
− Control	0	0

in the impactor increases in velocity as it passes through stages A–E, imperilling virions collected at stage D to a greater extent than virions collected at earlier stages. Yet despite these potential adverse conditions, we isolated viable virus from stage D of the impactor.

This was intended as an initial, observational study, to confirm the presence of viable SARS-CoV-2 virus in a car after a short drive by an infected driver. Additional studies, making use of patients with a range of viral loads, with and without masks, and utilizing varying patterns of air flow within the car (with and without circulation of outside air, etc.) will be necessary to fine-tune the characteristics of viral flow within the vehicle (Mathai et al., 2021). Nonetheless, our data substantiate the potential risk of SARS-CoV-2 transmission by minimally symptomatic persons in the closed space inside of a car (with closed windows and air conditioning running) and suggest that a substantial component of that risk is via aerosolized virus.

Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Ethical approval

The study was reviewed and approved by the University of Florida Institutional Review Board.

References

CDC. Coronavirus disease 2019 (COVID-19). Frequently asked questions. 2020. . . [Accessed 7 September 2020] https://www.cdc.gov/coronavirus/2019-ncov/faq.html.

CDC. Wear face masks on public transportation conveyances and at transportation hubs. 2020. . . Updated 10/29/2020. [Accessed 19 November 2020] https://www.cdc.gov/coronavirus/2019-ncov/travelers/face-masks-public-transportation.html.

Fabian P, McDevitt JJ, Lee WM, Houseman EA, Milton DK. An optimized method to detect influenza virus and human rhinovirus from exhaled breath and the airborne environment. J Environ Monit 2009;11(2):314–7.

Fears AC, Klimstra WB, Duprex P, Hartman A, Weaver SC, Plante KS, et al. Persistence of severe acute respiratory syndrome coronavirus 2 in aerosol suspensions. Emerg Infect Dis 2020;26(September (9))2168–7271, doi:http://dx.doi.org/10.3201/eid2609.201806 Epub 22 June 2020. PMID: 32568661; PMCID: PMC7454081.

GISAID. Clade and lineage nomenclature, July 4, 2020. Clade and lineage nomenclature aids in genomic epidemiology of active hCoV-19 viruses. [Accessed 12 July 2020] https://www.gisaid.org/references/in-focus-archive/.

Hamner L, Dubbel P, Capron I, Ross A, Jorday A, Lee J, et al. High SARS-CoV-2 attack rate following exposure at a choir practice — Skagit County, Washington, March 20. Morbid Mortal Wkly Rep 2020;69(May (19)):606–10, doi:http://dx.doi.org/10.15585/mmwr.mm6919e6.

Lednicky JA, Loeb JC. Detection and isolation of airborne influenza A H3N2 virus using a Sioutas Personal Cascade Impactor Sampler. Influenza Res Treat 2013;2013:656825, doi:http://dx.doi.org/10.1155/2013/656825.

Lednicky JA, Shankar SN, Elbadry MA, Gibson JC, Alam MdM, Stephenson CJ, et al. Collection of SARS-CoV-2 virus from the air of a clinic within a university

student health care center and analyses of the viral genomic sequence. Aerosol Air Qual Res 2020a;20(6)1167–71, doi:http://dx.doi.org/10.4209/aaqr.2020.02.0202 Epub 2020 May 25. PMID: 33424954; PMCID: PMC7792982.

Lednicky JA, Lauzardo M, Fan ZH, Jutla A, Tilly TB, Gangwar M, Int J Infect Dis 2020b;100(September)476–82, doi:http://dx.doi.org/10.1016/j.ijid.2020.09.025 Epub ahead of print. PMID: 32949774; PMCID: PMC7493737.

Lee EC, Wada NI, Grabowski MK, Gurley ES, Lessler J. The engines of SARS-CoV-2 spread. Science 2020;370:406–7.

Mathai V, Das A, Bailey JA, Breuer K. Airflows inside passenger cars and implilcatons for airborne disease transmission. Sci Adv 2021;7(1)eabe0166, doi:http://dx.doi.org/10.1126/sciadv.abe0166 PMID: 33277325; PMCID: PMC7775778.

Mercatelli D, Giorgi FM. Geographic and genomic distribution of SARS-CoV-2 mutations. Front Microbiol 2020;11:1800, doi:http://dx.doi.org/10.3389/fmicb.2020.01800.

Misra C, Singh M, Shen S, Sioutas C, Hall PM. Development and evaluation of a personal cascade impactor sampler (PCIS). J Aerosol Sci 2002;33(7):1027–47.

Ng OT, Marimuthu K, Koh V, Pang J, Linn KZ, Sun J, et al. SARS-CoV-2 seroprevalence and transmission risk factors among high-risk close contacts: a retrospective cohort study. Lancet Infect Dis 2021;21(3)333–43, doi:http://dx.doi.org/10.1016/S1473-3099(20)30833-1 Epub 2020 Nov 2. PMID: 33152271; PMCID: PMC7831879; Published online 2 November 2020.

Pan M, Lednicky JA, Wu CY. Collection, particle sizing and detection of airborne viruses. J Appl Microbiol 2019;127(December (6))1596–611, doi:http://dx.doi.org/10.1111/jam.14278 Epub 26 June 2019. PMID: 30974505.

Park SY, Kim Y-M, Yi S, Lee S, Na B-J, Kim CB, et al. Coronavirus disease outbreak in Call Center, South Korea. Emerg Infect Dis J 2020;26:.

Rahmani AR, Leili M, Azarian G, Poormohammadi A. Sampling and detection of corona viruses in air: a mini review. Sci Total Environ 2020;740(October) 140207, doi:http://dx.doi.org/10.1016/j.scitotenv.2020.140207 Epub 15 June 2020. PMID: 32554029; PMCID: PMC7295527..

Santarpia JL, Rivera DN, Herrera VL, Morwitzer MJ, Creager HM, Santarpia GW, et al. Aerosol and surface contamination of SARS-CoV-2 observed in quarantine and isolation care. Sci Rep 2020;10(July (1))12732, doi:http://dx.doi.org/10.1038/s41598-020-69286-3 Erratum in: Sci Rep. 2020 Aug 12;10(1):13892. PMID: 32728118; PMCID: PMC7391640.

Somsen GA, van Rijn C, Kooij S, Bem RA, Bonn D. Small droplet aerosols in poorly ventilated spaces and SARS-CoV-2 transmission. Lancet Respir Med 2020;(May). https://wwwnc.cdc.gov/eid/article/26/8/20-1274_article.

Tang JW. The effect of environmental parameters on the survival of airborne infectious agents. J R Soc Interface 2009;6(Suppl. 6):S737.

Verreault D, Moineau S, Duchaine C. Methods for sampling of airborne viruses. Microbiol Mol Biol Rev 2008;72:413–44.

World Health Organization. Modes of transmission of virus causing COVID-19: implications for IPC precaution recommendations: scientific brief, 27 March 2020. 2020 (WHO/2019-nCoV/Sci_Brief/Transmission_modes/2020.2) [Accessed 9 July 2020].

Exhibit v

AIHA™

HEALTHIER WORKPLACES | A HEALTHIER WORLD

Reducing the Risk of COVID-19 using Engineering Controls

Guidance Document

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Exhibit V

Version 1 | August 11, 2020

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Early case reports and epidemiological studies of groups where SARS-CoV-2 has led to outbreaks of COVID-19 indicates that the primary means of disease transmission is the indoor spread of exhaled droplet aerosols. Armed with this knowledge, industrial hygiene professionals may limit SARS-CoV-2 transmission using the hierarchy of controls. Engineering controls that can keep infectious aerosols at very low levels indoors offer the greatest promise to protect non-healthcare workers and other vulnerable populations as we reopen our businesses and workplaces.

Relying upon individuals to maintain social distancing, perform perpetual hand washing, and, when available, wear the lowest form of personal protective equipment (PPE) on the market can only achieve so much in preventing the spread of COVID-19. And because infected people transmitting the disease can be asymptomatic or presymptomatic, it is impractical to "eliminate" all sources of infection. With this in mind, the industrial hygiene profession has long recognized that engineered solutions to reduce exposure to hazardous agents offer much greater protection than PPE or administrative controls in most workplace settings. (NIOSH) (See Figure 1)

Many employers and the public incorrectly assume that wearing face coverings or a respirator is the only way to reduce their risk of exposure. Invariably this is not the case—the reality is that wearing a respirator properly every day, all day, is uncomfortable and rarely done properly. Engineering controls have historically proven to be more reliable because they are less prone to human error.

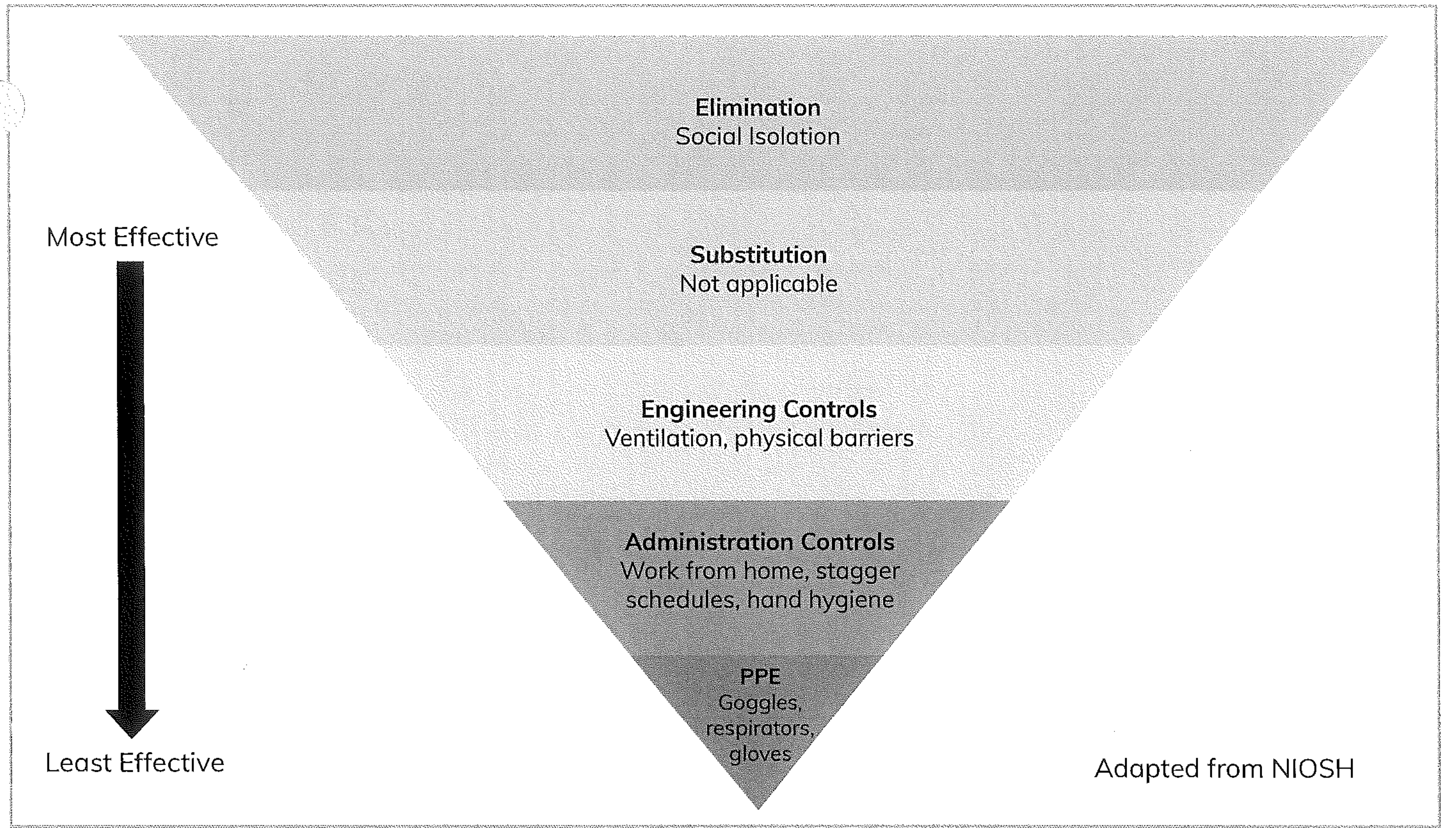

Figure 1: Applying the Hierarchy of Controls for COVID-19.

Accordingly, while federal and state OSHA plans require employers to ensure workers can use a selected respirator, OSHA also requires employers to consider feasible engineering and administrative options before resorting to their use or that of other PPE. Employers should select off-the-shelf, reliable, and effective engineering controls to reduce the risk of workplace disease spread.

The cost of PPE is also higher than most employers realize. Because OSHA requires medical evaluation, fit testing, and training, respiratory PPE is not a recommended long-term solution to prevent disease transmission outside of healthcare settings. Respiratory PPE is best used for short-term protection until engineering controls can be implemented. Costs to implement engineered solutions in a workplace can vary, depending upon the size of the facility and number of occupants, including employees and transient customers. Once engineering controls are installed, concerns of shortages and supply interruptions that have plagued PPE supplies are not likely to be an issue.

The American Industrial Hygiene Association (AIHA) and its volunteer committees of industrial hygienists recommend the use of engineering controls in all indoor workplaces, even those outside of the healthcare industry, to reduce the spread of COVID-19. The broad category of engineering controls that may be effective against the SARS-CoV-2 virus includes the following:

- Physical barriers, enclosures, and guards
- Automatic door openers and sensors
- Local exhaust ventilation
- Enhanced filtration to capture infectious aerosols
- Devices that inactivate or "kill" infectious organisms
- Dilution ventilation and increasing outside air delivery

Dilution Ventilation and COVID-19

Exemplifying one kind of engineered control, ASHRAE, a professional association of engineers, has issued position statements maintaining that changes to building and HVAC operation can reduce the airborne concentration of SARS-CoV-2 and the risk of it spreading through indoor air.

Increasing the number of effective air changes per hour—essentially, increasing the amount of "clean" or outdoor air delivered to the room—lowers the occupant's level of exposure to airborne viruses and therefore his or her relative risk of contracting the disease. Diluting indoor airborne virus concentrations can lower the risk of contracting the disease for the same reason that outdoor environments pose less risk of disease transmission.

This suggests that the risk of contracting COVID-19 can be significantly reduced by increasing indoor dilution ventilation rates and improving room air mixing—a principle recommended by the CDC and healthcare licensing bodies for hospitals and infectious disease wards. Indoor environments pose a much greater risk of exposure and spread of disease than outdoor environments. Outdoor environments offer "infinite dilution" of infectious aerosols, which strongly suggests that the risk of contracting COVID-19 can be significantly reduced by increasing dilution ventilation rates and improving room air mixing. To reduce the risk of disease transmission, maintain aerosol concentrations at very low levels, keep occupancy density low, and maintain physical distance. Accordingly, fundamental principles and equipment to capture and dilute aerosols can be applied to non-industrial workplaces to achieve more effective and reliable control of SARS-CoV-2 than face coverings and social distancing.

Effectively increasing the number of air changes in a room or building can be achieved by one or more of the following approaches. Using stand-

alone "off-the-shelf" HEPA filtered air cleaners , installing enhanced filtration in central HVAC systems, and increasing the volume of outside air introduction are practical and immediate measures that can be implemented by building operators and employers.

Properly selected and installed, standalone single-space HEPA filtration units that are ceiling mounted or portable can effectively reduce infectious aerosol concentrations in a single space room or zone, such as a classroom, elevator, lobby, or office area. While in-room filtering units cannot eliminate all risk of disease transmission because many factors besides virus aerosol concentration contribute to the issue, the reduced concentration and residence time of infectious aerosols can substantially decrease an individual's likelihood of inhaling an infectious dose. (ASHRAE Position Statement on Infectious Aerosols, 2020)

Choosing and Implementing Engineered Controls

Compared to solutions relying mostly or exclusively on PPE, engineered solutions removes the onus from individuals and their personal habits or attentiveness. Machines do not get tired, sloppy, or distracted.

However, when selecting engineering controls, such as increasing the number of air changes per hour (ACH), the minimum level of protection offered by the new control should exceed the protection offered by PPE alone. In Figure 2, the expected relative risk reduction offered by an N95 respirator is 90 percent, therefore only engineering controls that offer greater than 90 percent relative risk reduction should be considered. In this instance, engineering controls that offer fewer than 4.5 effective air changes per hour are no better than commercially available respiratory protection.

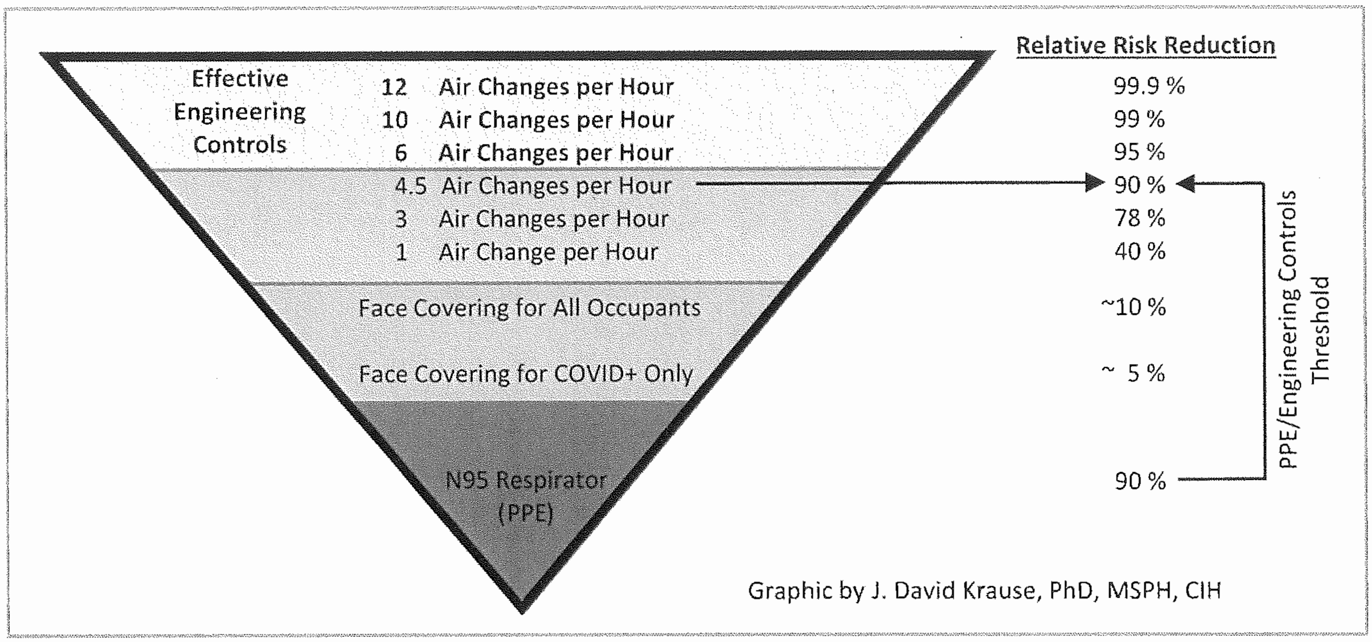

Figure 2

In hospitals and other indoor environments where infectious people are likely present, delivering between 6 and 12 air changes per hour of outside or clean air significantly reduces the spread of infectious airborne diseases. (See Figure 3) In non-healthcare facilities where occupant density cannot be limited to fewer than 1 person per ~30 ft^2 (i.e. 6-foot radius), or there is likelihood that infected persons are present, delivering higher air change rates than 6 ACH may be necessary.

Additional factors must be considered for site-specific engineering controls, such as in-room air mixing, the number of occupants per square foot of office space, and the air flow dynamics already in place. A knowledgeable mechanical engineer and industrial hygienist familiar with ventilation controls and infection prevention should be consulted when selecting, installing, and evaluating engineering controls for a workplace.

In most office buildings and small retail settings, using a computational fluid dynamics (CFD) model is not necessary to achieve intended effects. However, in complex buildings with existing mechanical and exhaust systems, CFD modeling may be needed to design and implement a robust and reliable system.

Standalone high efficiency particulate arrestance (HEPA) air filtering devices (AFDs) can be used to supplement outdoor air ventilation supplied through HVAC systems in order to achieve equivalent air exchange rates (AERs) capable of significantly reducing infectious aerosol concentrations in workplaces and offices. The CDC's *Guidelines for Environmental Infection Control in Health-Care Facilities*, published in 2003 recommends using recirculation HEPA filters to "increase the equivalent room air exchanges." The guidelines further suggest that "recirculating devices with HEPA filters may have potential uses in existing facilities as interim, supplemental environmen-

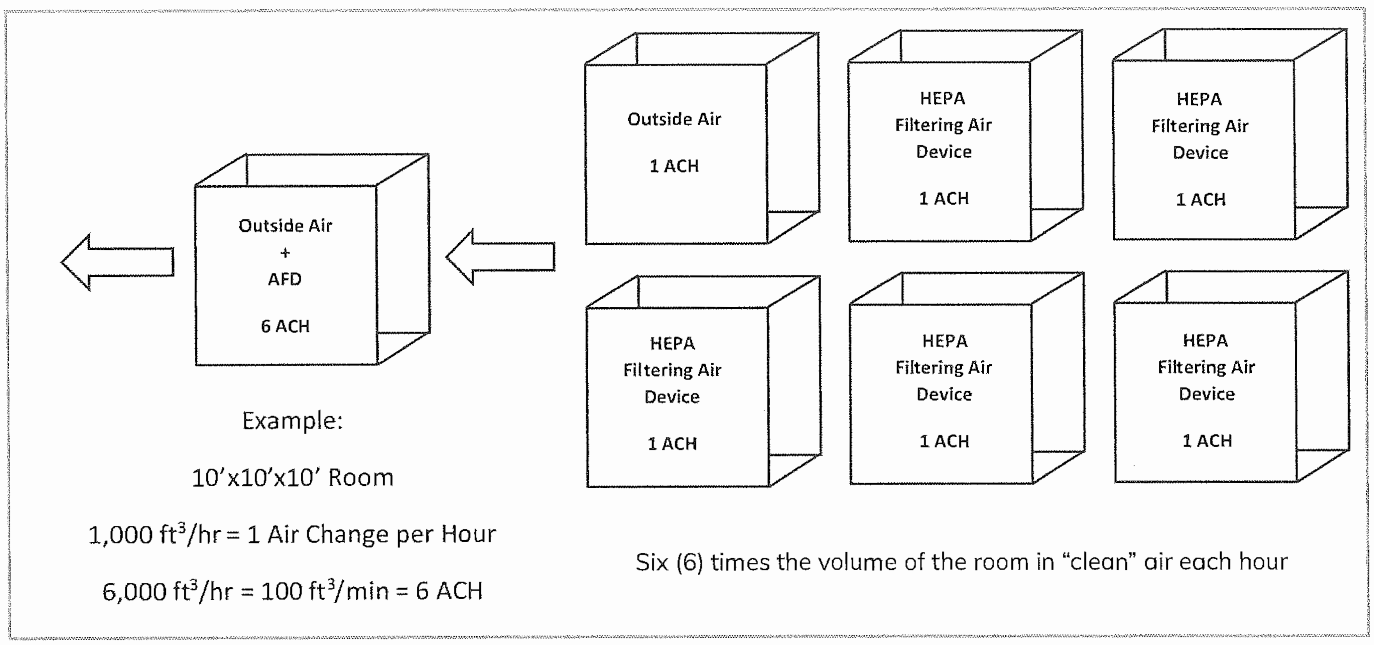

Figure 3

tal controls to meet requirements for the control of airborne infectious agents." (https://www.cdc.gov/infectioncontrol/guidelines/environmental/appendix/air.html#tableb1)

But HEPA rated filters are not necessary to achieve meaningful reductions in airborne concentrations. Enhanced filtration using filters with MERV (minimum efficiency reporting value) ratings between 13 and 15 can also be used, but higher flow rates may be necessary to achieve similar effects. Installing improved filtration (MERV 13 or higher) in central HVAC systems can serve to supplement air change rates by further reducing infectious aerosol concentrations in recirculated air. Increasing filtration of an HVAC system should be evaluated by a mechanical engineer to ensure the fan can handle the increased pressure load and that air does not bypass the filters. Increased maintenance and filter changes will likely be needed.

While ultraviolet germicidal irradiation (UVGI) and other technologies to inactivate, but not capture, viruses may be capable of reducing airborne concentrations of infectious aerosols, many factors can reduce their effectiveness without being readily recognized by users. Such technologies and equipment can often require significant modification to existing mechanical equipment and ongoing service.

Engineering Precautions

When increasing outside air delivery through HVAC systems, engineers must take precautions to avoid exceeding the mechanical system's design and operational capabilities. Too much outdoor air can introduce high levels of humidity, causing mold and bacterial growth within the HVAC system, its ducts, and the occupied areas of the building. When outdoor air pollution from wildfires, nearby excavation, or demolition activities threatens the area, outside air dampers may have to be temporarily closed.

When installing AFDs it is important to avoid air flows that interfere with existing HVAC systems, or that directs potentially contaminated air into a clean area. This often requires the expertise of an engineer, industrial hygienist, or experienced contractor to properly site each device.

Ongoing maintenance and cleaning of AFDs, including changing pre-filters and HEPA filters, is necessary to ensure effective operation. Precautions must be taken to prevent worker exposures to accumulated infectious viruses on the filters or the AFD exterior during filter changes and maintenance. PPE recommended for maintenance activities such as filter changes and periodic cleaning include goggles, gloves, apron, and N95 respirator. This should be performed when unprotected individuals are not nearby.

Any modifications made to central HVAC systems, either to accommodate a new use of the space, changes in occupant density, or to improve filtration should be specified and reviewed by a mechanical engineer.

Conclusions

As the nation moves to restart the economy and in-person education, we must seriously consider and adopt effective engineering controls in public buildings in order to protect the health of employees and occupant. Using "off-the-shelf" technologies, equipment, and time-tested methods to control infectious aerosols is the most reliable way to reduce the risk of disease spread. Relying upon control measures that only offer marginal protection against the spread of disease could extend this pandemic until a vaccine is developed, produced, and distributed. Scientifically proven methods to control the spread of airborne diseases that include enhanced ventilation with outdoor air, and high efficiency filtration, have not been widely implemented outside of healthcare facilities.

Industrial hygienists and mechanical engineers can design, install, and evaluate engineering controls that are capable of keeping infectious aerosols at very low levels indoors and offer more reliable protection. Together, we can help reduce the risk of disease transmission among workers and members of the community in properly designed and maintained buildings through the use of engineering controls.

Exhibit vi

Physics of Fluids

Experimental investigation of indoor aerosol dispersion and accumulation in the context of COVID-19: Effects of masks and ventilation

Cite as: Phys. Fluids **33**, 073315 (2021); https://doi.org/10.1063/5.0057100
Submitted: 17 May 2021 . Accepted: 02 July 2021 . Published Online: 21 July 2021

Yash Shah, John W. Kurelek, Sean D. Peterson, Serhiy Yarusevych, et al.

Exhibit vi

Physics of Fluids ARTICLE scitation.org/journal/phf

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Yash Shah, John W. Kurelek, Sean D. Peterson, and Serhiy Yarusevych[a]

AFFILIATIONS

Mechanical and Mechatronics Engineering, University of Waterloo, Waterloo, Ontario N2L 3G1, Canada

Note: This paper is part of the special topic, Flow and the Virus.
[a]**Author to whom correspondence should be addressed:** syarus@uwaterloo.ca

ABSTRACT

The ongoing COVID-19 pandemic has highlighted the importance of aerosol dispersion in disease transmission in indoor environments. The present study experimentally investigates the dispersion and build-up of an exhaled aerosol modeled with polydisperse microscopic particles (approximately 1 μm mean diameter) by a seated manikin in a relatively large indoor environment. The aims are to offer quantitative insight into the effect of common face masks and ventilation/air purification, and to provide relevant experimental metrics for modeling and risk assessment. Measurements demonstrate that all tested masks provide protection in the immediate vicinity of the host primarily through the redirection and reduction of expiratory momentum. However, leakages are observed to result in notable decreases in mask efficiency relative to the ideal filtration efficiency of the mask material, even in the case of high-efficiency masks, such as the R95 or KN95. Tests conducted in the far field (2 m distance from the subject) capture significant aerosol build-up in the indoor space over a long duration (10 h). A quantitative measure of apparent exhalation filtration efficiency is provided based on experimental data assimilation to a simplified model. The results demonstrate that the apparent exhalation filtration efficiency is significantly lower than the ideal filtration efficiency of the mask material. Nevertheless, high-efficiency masks, such as the KN95, still offer substantially higher apparent filtration efficiencies (60% and 46% for R95 and KN95 masks, respectively) than the more commonly used cloth (10%) and surgical masks (12%), and therefore are still the recommended choice in mitigating airborne disease transmission indoors. The results also suggest that, while higher ventilation capacities are required to fully mitigate aerosol build-up, even relatively low air-change rates (2 h^{-1}) lead to lower aerosol build-up compared to the best performing mask in an unventilated space.

I. INTRODUCTION

Expiratory events, such as breathing, speaking, sneezing, or coughing, produce droplets, ranging in micrometers to millimeters in size, that serve as the primary pathway for the transmission of many infectious diseases, including coronavirus disease 2019 (COVID-19).[1–6] The ongoing COVID-19 pandemic underscored glaring gaps in our understanding of pathogen transmission required to effectively contain and prevent outbreaks, including, but not limited to, the development of reliable guidelines for safe social distancing,[1,2] usage of personal protective equipment (PPE),[7,8] and indoor ventilation.[1,9] The initial guidelines released in early 2020 by the World Health Organization and many national health agencies assumed that COVID-19 spreads primarily through large droplets that settle on surfaces within 1 to 2 m from the infected individuals. Although an intense scientific debate on the main transmission pathways of COVID-19 continues,[10,11] the mounting data on local outbreaks and relevant research[9,12,13] have prompted significant modifications to official guidelines, which now attribute the spread of COVID-19 to a wide range of droplet sizes, including both larger respiratory droplets and microscopic aerosols, produced during various expiratory events.[14–18]

Recent research has shown that smaller droplets and droplet nuclei containing significant viral load can travel up to 8 m during expiratory events,[3] substantially exceeding the present social distancing limits. Furthermore, the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has been shown to retain infectivity in aerosol form for a minimum of three hours past expiration from an infected person,[5] making it possible for the pathogens to be transported over extended distances due to ambient flows in indoor

Physics of Fluids ARTICLE scitation.org/journal/phf

environments.[8,11,17–20] The critical importance of safety considerations at indoor workplaces has been recently highlighted by the analysis of various COVID-19 superspreader events,[13] the vast majority of which took place indoors. This underscores the importance of understanding the spread and accumulation of human-borne aerosols in indoor environments through the lens of social distancing, mask usage, occupancy, exposure duration limits, and ventilation.

Another contentious issue brought to the forefront of scientific debates by the COVID-19 pandemic is the efficacy of face masks.[7,8] Although some clinical evidence of respirator mask efficiency existed prior to the COVID-19 pandemic,[21] there is mounting evidence that continuous usage of appropriate face masks can reduce the rate of virus transmission;[7,8] however, the efficacy of different mask types for both the reduction of viral emissions and prevention of individual inhalation of pathogens requires further quantitative analysis.[12] This is of particular importance for indoor settings, where PPE can significantly affect the accumulation of the pathogens and their transmission through filtration and reduction/redirection of momentum during expiratory events.

Recent observational studies and meta-analyses of mask effectiveness have estimated that mask usage reduces the risk of respiratory virus spread by 70% to 80%.[22] Efficacy of home-made masks at preventing spread of influenza showed that surgical masks are three times more effective at blocking micro-organism transmission than home-made masks[23–25] although none of these studies include randomized control trials.[26] There is, however, evidence that communities in which masks were in widespread use exhibited significantly reduced community spread.[24,25]

The higher risk of infectious disease transmission in indoor environments, particularly with poor ventilation, has been recognized in the scientific community well before the onset of the COVID-19 pandemic[27] and prompted a number of studies on transmission and aerosol transport indoors.[28–31] The ongoing COVID-19 pandemic has re-invigorated the research efforts in this area due to the growing association between local outbreaks and various indoor settings. For example, Qian *et al.*[13] reported that all except one of the 318 analyzed COVID-19 outbreaks were associated with indoor spaces. Bhagat *et al.*[32] provided an overview of potential effects of ventilation on the indoor spread of COVID-19, and general guidelines for minimizing airborne transmission are detailed in Morawska *et al.*[11] Mittal, Meneveau, and Wu[33] proposed a framework for estimating the risk of airborne transmission of COVID-19 based on probabilistic factors and highlighted the critical need for reliable quantification of key model parameters for future modeling and validation.

The airborne transmission of pathogens in indoor environment is directly related to the dynamics of virus-laden aerosols.[28] The associated transmission risk models are based on either simplified analytical formulations[34–36] or computational fluid dynamics (CFD) tools.[17,33,37] The former typically employ a well-mixed room assumption, where pathogen carrying aerosols are assumed to be instantaneously and uniformly distributed in a given room, such as in the classical Wells–Riley equation.[34] Such simplified modeling has also been employed for COVID-19 risk assessment.[36,38] On the other hand, at the expense of notably higher computational costs and model complexity, CFD-based modeling can provide added insight into spatial evolution of aerosols produced by various expiratory events in realistic indoor environments. Along these lines, a number of studies have modeled airborne spread of COVID-19;[17,39] however, all models rely on quantitative results from experimental studies for an array of input parameters, such as the initial number and size distribution of aerosol particles and initial velocities and duration of expiratory events. Further, the use of PPE, including face masks, needs to be incorporated into computational models, which either significantly complicates the modeling[40] or requires experimental data.[33] Thus, there is a need to incorporate the progress made in a number of recent qualitative and quantitative studies focused on PPE performance into larger-scale investigations focused on aerosol dispersion in indoor environments. This will provide a more comprehensive outlook on workplace health and safety, where the use of PPE is not only often mandated by local legislature, but also can help mitigate the limitation of available ventilation options.

The present study is aimed at bridging the gap between studies focused on face mask efficacy assessment and indoor dispersion of aerosols by experimentally evaluating the aerosol accumulation in a controlled indoor environment, with various types of face masks and ventilation settings considered. Typical nasal breathing is modeled in the present work using a high-fidelity physical model. While this type of expiration is known to produce the lowest aerosol counts per event, this type of breathing is the most common type of expiration and thus accounts for the majority of aerosol production during continuous occupancy at work and public places.[41] A combination of flow visualization, velocity and concentration measurements, and modeling is used to provide a quantitative outlook on the effect of different face masks on aerosol build-up over extended time periods in a generic indoor setting. The result provides critical estimates of apparent filtration efficiency essential for producing adaptive health and safety guidelines for workplaces during pandemic and epidemic events as well as for the development of advanced modeling tools.

II. METHODOLOGY

Experiments were conducted in the Fluid Mechanics Research Laboratory at the University of Waterloo. An overview of the setup is provided in Fig. 1(a). All tests were performed in a $7.8 \times 5.7 \times 2.7$ m room with an air volume of approximately 120 m^3 that was vacated except for the test model and essential equipment. To study the dispersion of exhaled aerosols in an unventilated space, the room was sealed from all surroundings, which included shutting off the ventilation system and sealing all air passageways through the room envelope.

The test model was a Prestan adult CPR manikin (model PP-AM-100-DS), placed upright in a seated position on a chair in the center of the room [Figs. 1(a) and 2(a)]. Breathing with aerosol-laden exhalation was provided by a custom breathing apparatus, the details of which are provided in Fig. 1(b). The positive and negative air pressure cycle was provided by a mechanical ventilator (developed and donated to the project by Crystal Fountains, Inc.), which operated through the repeated compression and decompression of an adult size med-rescuer bag-valve-mask (BVM) (1500 mL bag volume) by a pneumatic piston. Physiological parameters representative of typical adult nasal breathing[42] were set in terms of respiratory period/rate, exhalation time, and breath volume through adjustment of the piston plunging depth, forward and backward stroke speeds, and contact time with the BVM, resulting in the breathing parameters reported in Table I. These parameters were monitored and logged during operation of the ventilator via forward and backward stroke limit switches

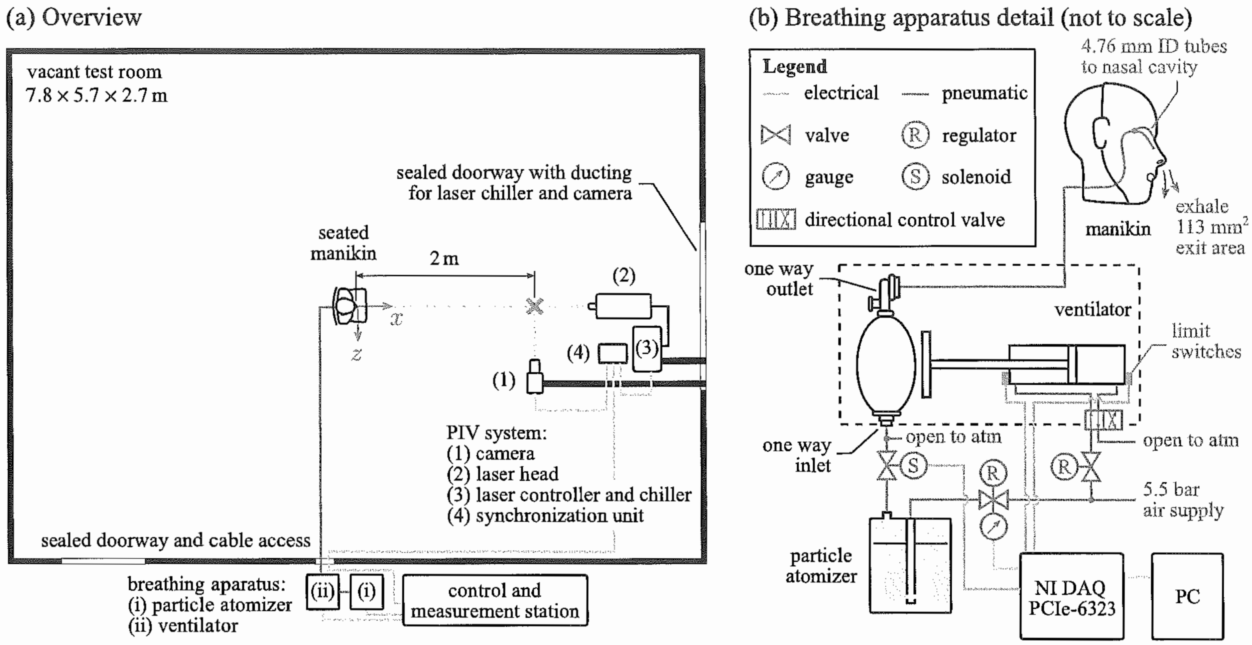

FIG. 1. (a) Overview of the experimental setup and (b) details of the breathing apparatus.

on the piston, with signal sampling performed using National Instruments' LabVIEW software and a PCIe-6323 DAQ.

Aerosols were produced by atomizing olive oil into particles with a mean diameter of about 1 μm (volume-weighted) using a Laskin nozzle style atomizer based on the designs of Kahler, Sammler, and Kompenhans.[43] Controlled injection of particles into the breathing stream was achieved using a normally closed solenoid valve located downstream of the atomizer, the opening of which was synchronized with the breathing cycle through LabVIEW. The solenoid was opened at the start of inhalation (i.e., at the forward stroke limit) and was held open for 2.0 s as this matched the re-inflation time of the BVM without particle injection. The particle production rate was controlled by a pressure regulating valve upstream of the atomizer, the pressure of which was logged in LabVIEW and remained within 0.172 bar $\pm$0.5 % throughout operation. This pressure level was verified to be below the minimum pressure needed to open the BVM outlet valve, therefore ensuring exhaust from the BVM during the exhalation (compression) portion of the cycle only. Olive oil was selected for the aerosol liquid

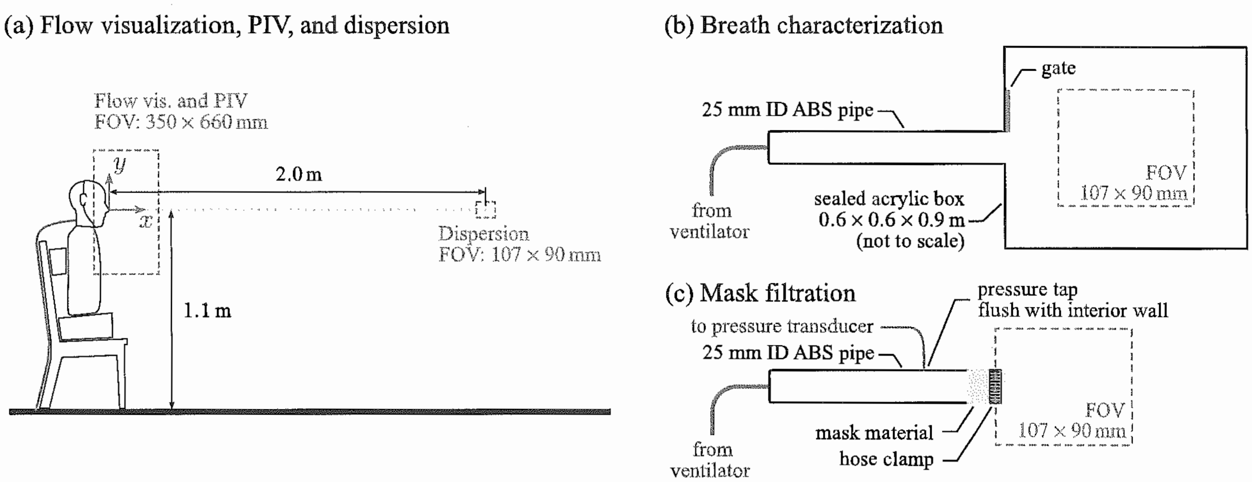

FIG. 2. Profile view of experimental setups for (a) flow visualization, PIV, and dispersion tests, (b) breath characterization, and (c) mask filtration tests.

TABLE I. Breathing and aerosol production parameters (95% confidence).

Parameter	Value	Unit
Exhalation time	1.75±2%	s
Respiratory period	4.32±2%	s
Respiratory rate	13.9±2%	breath/min
Breath volume	690±3.5%	mL
Avg. exhalation flow rate[a]	0.40±4%	L s^{-1}
Particles injected	2.75×10^8 ±7.5%	particles/breath
Breath particle concentration	3.98×10^8 ±8%	particles/l

[a]Flow rate computed over exhalation time.

component as its use in an atomizer of this design is known to give a polydisperse distribution of particle sizes with a mean diameter of approximately 1 μm,[45] matching the smaller scale of aerosols expelled during typical human respiration,[11,44,45] and the nuclei formed after larger droplets evaporate.[46] Furthermore, oil-based aerosols offer good light scattering properties for optical detection, are charge-neutral,[47] and have a residence time on the order of several hours, in comparison to several minutes for water-based alternatives, which is critical given the approximate one hour viability half-life of the SARS-CoV-2 virus[5] and that virion containing droplet nuclei may remain suspended in air for hours.[7] It should be noted that higher exhalation aerosol concentrations than those typical for normal breathing[11,48,49] was employed (Table I) to reduce measurement uncertainty in experimental aerosol concentration estimates. For consistent data comparison, all concentration measurements are normalized by the initial breath particle concentration, which was maintained constant throughout the study.

The breathing apparatus and measurement control station were located outside of the test room [Fig. 1(a)], with all connections to the interior passed through a sealed cable access. This allowed for tests to be controlled from outside the room, thereby removing any unintended effects the presence of the breathing apparatus, control and measurement equipment, and/or test operators may have had on the results. The output of the ventilator was connected to the manikin using a 12.7 mm inner diameter flexible tube, which was split into two 4.76 mm inner diameter tubes that exhaust into the manikin's nasal cavity. The total nostril exit area was 113 ms^{-1}, which is within the expected range for male adults.[50] The limitations of this experimental setup are the absence of a thermal plume typically present around a human being[52] and that the inhalation does not occur at the manikin, but rather at the inlet of the BVM [Fig. 1(b)].

Qualitative and quantitative measures of aerosol dispersion from the test model were performed using simultaneous illumination and imaging of particles with a laser and digital camera, respectively [Fig. 1(a)]. The methodology constitutes planar particle image velocimetry (PIV) measurements,[51] with the specific equipment employed including an EverGreen 70 mJ/pulse Nd:YAG laser, PCO sCMOS cameras (5.5 MP, 6.5 μm pixel pitch) fitted with 105 mm focal length macro lenses, and a LaVision PTUx timing unit. This equipment was located in the test room, with the air needed for camera and laser cooling supplied through dedicated ventilation ducting connected to a nearby sealed doorway, ensuring no air exchange with the test environment. Control and data acquisition were performed from the exterior measurement station using LaVision's DaVis 10.0 software. The ventilator limit switch signals were passed into the PIV timing unit, allowing for measurement synchronization with the breathing cycle.

Measurements involving the manikin were performed in two locations, both depicted in Fig. 2(a), with the measurement planes located at the mid-span of the test model (within the x-y plane). The first measurement field of view (FOV) measured 350 × 650 mm, covering the area of exhaled breath for both masked and unmasked cases, and was imaged using two cameras, each at a magnification factor of 0.04. Here, flow visualization and PIV images were acquired at 15 Hz, with the latter requiring aerosol seeding of both the breathing stream and ambient environment. Double-frame PIV images were acquired using frame separation times between 15 and 20 ms, resulting in particle displacement below approximately 20 pixel. The particle images were then processed in DaVis 10 using sliding background subtraction and intensity normalization, followed by an iterative, multi-pass cross correlation algorithm with a final window size of 32 × 32 pixel (50% overlap) to determine local flow velocities at a spatial resolution of 2.98 mm.

At the second measurement location, a single camera was used to image a 107 × 90 mm FOV centered at the height of the exhalation point (1.1 m from the floor) but at a 2 m distance [Fig. 2(a)]. Here, single images were acquired at a rate of 0.25 Hz for up to 10 h in order to track the dispersion of exhaled aerosols from the test subject. In order to minimize the gradients of light intensity within the image, the laser sheet was expanded substantially larger than the dimensions of the field of view (approximately 200% more), such that the core region of the laser beam covered the entire field of view. The directivity of dispersion was investigated by rotating the manikin about the y-axis while keeping the measurement location fixed, with orientation angles of 0°, 90°, and 180° considered. For each case, imaged particles (2–3 pixel in the imaging plane) were detected and counted using a particle detection algorithm in DaVis 10.1 software, providing the measure of local particle concentration based on the average over the local measurement volume. The particle detection algorithm measures particle counts by scanning the image for peaks in local intensities after the image is pre-processed using a sliding minimum subtraction and low-pass Gaussian filter to enhance the individual intensity peaks. A threshold for the background noise is employed and kept constant between all the cases for consistency.

A total of seven PPE configurations were considered, with the manikin fitted with (i) no mask, (ii) an unvalved KN95 mask, (iii) a typical three-ply blue pseudo-surgical mask, (iv) a three-ply cotton cloth non-medical mask, (v) a 3M R95 particulate respirator (equivalent to N95 for human borne aerosols), (vi) an unvalved KN95 mask with 3 mm gaps around cheeks and nose, and (vii) a KN95 mask with a single one-way valve on the left side. The parameters presented in Table I were kept constant across all cases. To adjust for a higher average rigidity of the manikin face and have repeatable mask fits, straps typically worn around the ears were tightened by anchoring them to a single peg located inline with the top of the ears and at the center of the back of the head. Note that this was not the case for the R95 respirator, which has straps that circumnavigate the head and neck. Tests with the KN95 mask with artificial gaps [case (vi)] were performed by first ensuring the same baseline fit as that of the unvalved KN95 mask [case (ii)], with the gaps created by 3 mm thick pieces of vinyl foam placed on the cheeks and cheekbones of the manikin, which produced consistent leakage sites similar to the approach employed by Weber

et al.[56] The length of the foam pieces was minimized to reduce blockage while ensuring consistent gap dimensions between multiple runs.

Tests characterizing breath particle concentration, breath volume, and ideal mask filtration efficiency were also performed, with the setups used presented in Figs. 2(b) and 2(c). These tests utilized the same breathing apparatus, breathing parameters, and imaging setup as the dispersion tests, with the outlet of the ventilator fed to a 25 mm inner diameter rigid pipe. For characterization of the breath particle concentration, the outlet of the pipe was fed into an acrylic box (dimensions $0.6 \times 0.6 \times 0.9$ m) which was sealed off after a single breath and images were acquired at 1 Hz for 0.5 h. A uniform particle distribution was reached after approximately 15 min, after which the number of particles was measured. From this, and the FOV area and laser sheet thickness (2.0 mm), the total number of particles contained in the volume and therefore injected by the breath was estimated, resulting in the value reported in Table I. The provided uncertainty range is based on the variance found across ten runs of repeatability.

For breath volume, ideal mask filtration efficiency, and mask pressure drop characterizations, the outlet of the pipe was exhausted to open air and the measurement field of view was moved to the exit of the pipe, as shown in Fig. 2(c). Mask material was sealed around the pipe outlet using a 3 mm thick o-ring and hose clamp. PIV double-frame measurements with a frame separation times of 666 μs were acquired at 15 Hz for the duration of the exhalation over 50 cycles. Image processing was performed in DaVis 10 using sliding background subtraction and intensity normalization, followed by vector calculation using iterative, multi-pass cross correlation with a final window size of 24×24 pixel (75% overlap), yielding a spatial resolution of 0.25 mm. The resulting velocity field data were integrated to give phase average volumetric flow rate, yielding the total breath volume reported in Table I. A pressure tap flush with the interior of the pipe wall was installed two diameters upstream of the pipe exit and was connected to a Setra pressure transducer (Model 264), providing static pressure measurements relative to the local atmospheric pressure. For ideal mask filtration efficiency, the total number of particles exhausted over an exhalation cycle was counted. The result was then compared to the case with no mask, with 50 breath cycles used to establish a confidence interval.

III. RESULTS AND DISCUSSION

This section first discusses the ideal filtration characteristics of various masks used in the present study. Thereafter, the near-field flow visualization and velocity measurements around the face of the test subject are discussed. Finally, the results corresponding to particle dispersion in the test room are presented along with the supporting model results.

A. Baseline mask characteristics

Significant variability in essential mask characteristics has been reported in previous studies, which tends to be more significant for non-certified mask types. Thus, baseline parameters for each mask type considered in the present study have been established experimentally and ensured to be consistent for the same mask types tested here. The baseline ideal filtration characteristics of the studied masks are established for the breathing parameters (Table I) and aerosol employed in the study. An estimate of ideal filtration efficiency, and the associated pressure drop across the mask, is established through tests where the mask is sealed at the point of exhaust [Fig. 2(c), as described in Sec. II], thereby removing the dependency on mask fit to the test model. The results are presented in Fig. 3(a), showing the particle concentration during exhalation, with results averaged over 50 cycles and normalized by the peak concentrations reached in the unfiltered case (no mask).

In Fig. 3(a), for the no-mask case, exhalation begins at approximately 0.5 s, with particle counts downstream of the outlet increasing rapidly after the initiation of the exhalation, followed by an extended period of stabilization at the peak value, and a subsequent decrease in the particle concentration toward the end of the exhalation cycle. A

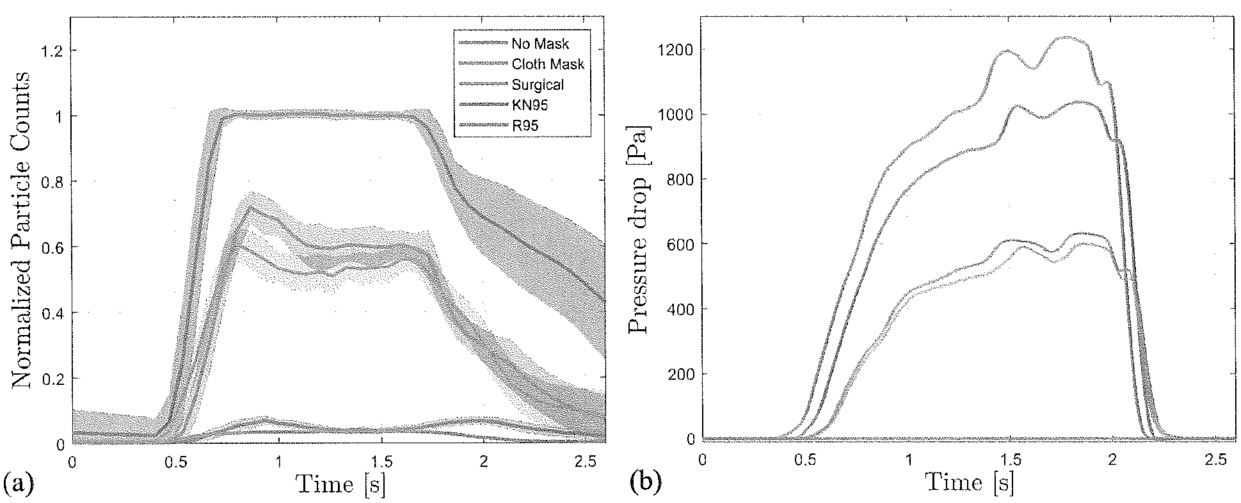

FIG. 3. (a) Particle counts after aerosol particles are passed through various masks and normalized by the particle counts at the plateau in the no-mask case, and (b) associated pressure drop across the mask at a flow rate of 0.4 L s^{-1}. Results are from the setup shown in Fig. 2(c) and are averaged over 50 exhalation cycles. Shaded areas correspond to ± 1 standard deviation. The standard deviations for pressure drop measurements are negligible, and thus, not visible.

similar trend is observed for the tested mask cases, with lower plateau values reached as a result of filtration. The ideal filtration efficiency for a mask is estimated by computing the change in the average particle concentration within the time interval of 1 and 1.5 s, i.e., the plateau value, relative to the no-mask case, with obtained results summarized in Table II. The efficiency of the KN95 and R95 masks is the highest at approximately 95% and 96%, respectively, which agrees well with the rated efficiencies for these masks in the absence of leakage. Such high efficiencies are attributed to the electrostatic filters embedded in these masks, which have been shown to effectively filter both charged and neutrally charged particles.[53,54] Filtration efficiencies for the blue surgical mask and cloth masks are significantly lower at 47% and 40%, respectively, meaning that more than half of the aerosol particles pass through these masks. The present results are in reasonable agreement with Jung *et al.*,[55] who compared filtration efficiencies of a number of medical and non-medical masks. Note that a relatively wide variation of filtration efficiencies has been reported for these types of PPE in previous studies,[56–58] largely attributed to the lack of stringent filtration performance standards.

Pressure drop across a mask and the corresponding flow resistance coefficient ($\Delta P/Q$, where Q is the peak flow rate) are important considerations since both provide measures of mask breathability and, consequently, comfort when worn by an individual, with a lower pressure drop and resistance coefficient indicating higher comfort. The results in Fig. 3(b), along with the parameters summarized in Table II, show that the KN95 and cloth masks have the highest pressure drops and resistance coefficients, indicating relatively poor breathability. In comparison, the pressure drop across the R95 mask is approximately 40% lower than that of the KN95 mask, which is significant given a similar level of filtration efficiency. Pressure drop across the surgical mask is comparable to that of the R95, indicating a similar level of breathability and comfort; however, this comes at the cost of significantly reduced filtration efficiency. It should be noted that substantial variability in measured pressure drop can occur even for the same mask types from different manufacturers;[26,56,57,59,60] however, the trends observed in the present measurements fall within the range of values reported previously. Therefore, these results can serve as a qualitative guide toward the balance between ideal filtration performance and breathability for common face masks.

B. Exhalation flow characterization

With baseline filtration characteristics of the masks established, their effect on the evolution of exhaled breath through the nose of the test model is now considered in the vicinity of the face using particle flow visualization and velocimetry techniques. Results for the KN95 and surgical mask are seen to qualitatively represent a high-efficiency mask and common cloth/non-medical masks, respectively. Thus, these two configurations are used here as representative face mask groups, and the results are contrasted with the no-mask case. Figure 4 illustrates nasal exhalation through an instantaneous flow visualization image at the vertical mid-plane of the face and at a phase angle of 180° within the breathing cycle (exhalation begins at 0°). Multimedia views included for each case depict the flow development over a few breathing cycles. The exhaled flow in the case of no mask [Fig. 4(a) (Multimedia view)] is typical of a transient turbulent jet, with the expelled aerosols directed downwards and the jet front reaching a distance from the nose of approximately 300 mm within approximately 1 s. The turbulent nature of the jet is apparent, with small scale eddies, visualized by particle clouds, present throughout the jet core, with the darker patches around the jet perimeter showing fluid entrained into the jet by turbulent mixing. In fitting the manikin with a mask, both the KN95 and surgical masks [Figs. 4(b) (Multimedia view) and 4(c) (Multimedia view), respectively] are successful in arresting nearly all forward momentum of the exhaled jet. As noted across the literature,[61–63] this is the primary protective mechanism of a mask for direct exposure to aerosols as it serves to reduce and redirect the forward momentum of the exhaled breath, which, as will be shown in Sec. III C, has a significant effect on the dispersion of exhaled aerosols away from the subject over time.

It is important to note that, while masks [Figs. 4(b) (Multimedia view) and 4(c) (Multimedia view)] decrease the forward momentum of the respiratory jet, a significant fraction of aerosol escapes the masks, particularly at the bridge of the nose. Further, aerosols can also be seen in front of the surgical mask due to the lower material filtration efficiency (Table II). These leakages are more readily apparent in the multimedia views. Recent studies employing similar visualization techniques for other types of expiratory events, such as sneezing, coughing, laughing, and speaking,[32,61,64] show similar leakage through surgical and common cloth masks. In those studies, higher pressure differences were imposed and therefore particles passing through the mask may have been expected, while the present results highlight that the pressure difference created by normal breathing is sufficient to cause aerosols to pass through the fabric of a surgical mask. In contrast, such leakage is negligible in the KN95 case [Fig. 4(b) (Multimedia view)], which is representative of high quality, certified masks.

As previously noted, a significant quantity of aerosol escapes at the bridge of the nose in Figs. 4(b) (Multimedia view) and 4(c) (Multimedia view), which highlights the importance of the fit of the mask to the face. Here, the fit of each mask is typical of appropriate usage, with the straps tightened (as outlined in Sec. II) and the built-in wire shaped to the bridge of nose. Nonetheless, aerosols escape at the perimeter of the mask due to inevitable imperfections in the mask fit, with the most significant quantity of particles escaping at the bridge of the nose. Other leakage sites include the interface of the mask edges with the cheeks and lower jaw [not captured in Figs. 4(b) (Multimedia view) and 4(c) (Multimedia view) due to laser sheet positioning]; however, these results and other supplementary measurements (not shown for brevity) confirm that leakage at the bridge of the nose far exceeds all other leakage points. At the bridge of the nose, the particle clouds that escape the masks are relatively dense in comparison to the exhaled

TABLE II. Filtration characteristics of various masks at an integrated flow rate of 0.4 L s^{-1}. ΔP and P_{dyn} indicate the peak pressure drop and the peak dynamic pressure, respectively, obtained at the peak flow rate ($Q = 0.61$ L s^{-1}). The 95% confidence intervals on the mean filtration efficiencies and peak pressure drop are within $\pm$1.5% and $\pm$0.25%, respectively, for all the cases.

Mask material	Filtration efficiency (%)	ΔP (Pa)	$\Delta P/P_{dyn}$	$\Delta P/Q$ (Pa s/m^3 $\times 10^{-5}$)
Cloth	40	1196	1356	19.67
Surgical	47	573	650	9.42
KN95	95	1014	1150	16.68
R95	96	606	687	9.97

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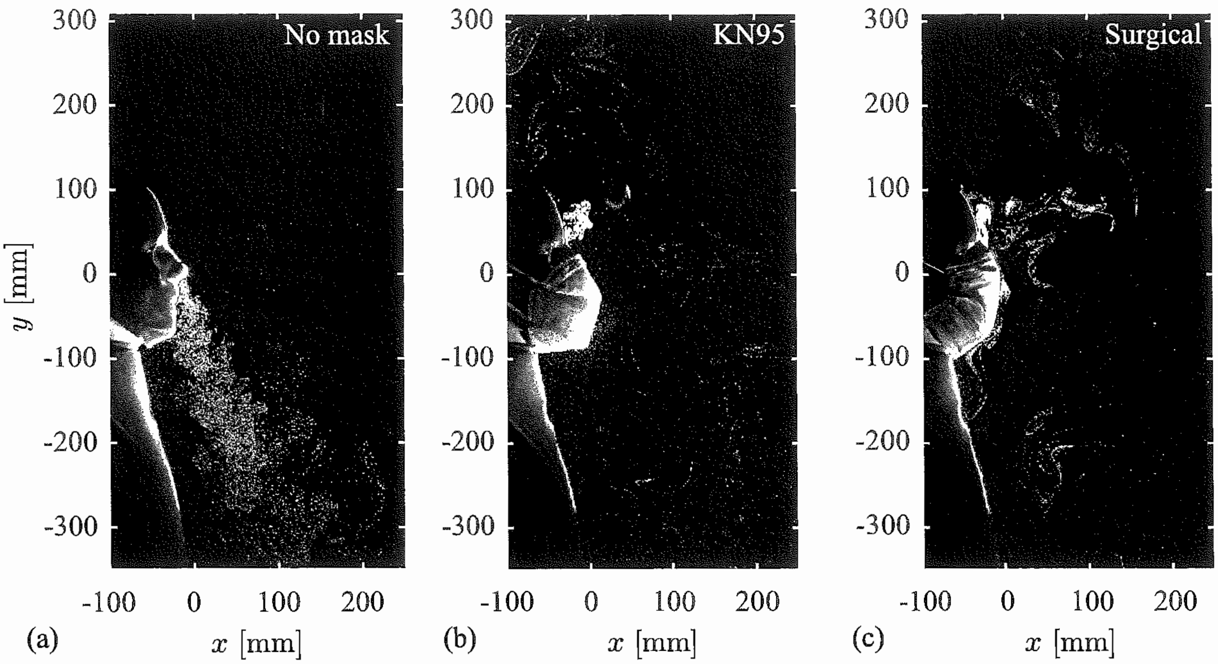

FIG. 4. Instantaneous flow visualizations at 180° within the breathing cycle for the (a) no mask, (b) KN95, and (c) surgical mask cases. Multimedia views: https://doi.org/10.1063/5.0057100.1; https://doi.org/10.1063/5.0057100.2; https://doi.org/10.1063/5.0057100.3

jet in the no-mask case, which is attributed to the significant redirection of momentum needed to force particles out at the top of the mask, resulting in much lower exit velocities and hence reduced turbulent diffusion. The observed particle concentrations just outside the mask qualitatively agree with the results of Sickbert-Bennett *et al.*[65,66] who obtained fitted filtration efficiency (FFE) estimates of more than 95% for inhalation with N95 type masks. However, their FFE estimates are based on the particle concentration entering the mask from the ambient air and are not directly indicative of the mask efficiency when considering the exhalation of aerosols. The results in Fig. 4 illustrate that a notable amount of particles leak out at the perimeter of all masks, which is expected to result in notably lower effective filtration efficiency, compared to ideal filtration efficiency, when exhalation is considered.

Figure 5 presents phase-averaged velocity fields, again at a phase angle of 180° within the breathing cycle, matching Fig. 4. Multimedia views are also provided for each case, showing phase-averaged velocity field development over the full exhalation cycle. Note that these measurements were performed at the mid-plane of the manikin face, not at the center of a given nostril. For the case with no mask [Fig. 5(a) (Multimedia view)], typical turbulent jet characteristics are noted, with jet propagation and spreading rate typical of accelerating jet flows.[67] Within the measurement plane, peak velocities range from 0.10 to 0.12 $\mathrm{ms^{-1}}$ in the core of the jet, which is within the range of velocities investigated in previous studies for normal breathing.[53,56,68–71] The results confirm that the forward momentum is decreased dramatically when the subject is fitted with a mask [Figs. 5(b) (Multimedia view) and 5(c) (Multimedia view)], as was seen in the flow visualizations (Fig. 4). For these cases, the expelled flow is directed primarily upward and backward by the mask and remains attached to the forehead due to the Coanda effect, with peak velocities reduced to less than 0.10 $\mathrm{ms^{-1}}$. For the surgical mask, the flow that penetrates through the front of the mask is of relatively low forward momentum and, consequently, much lower penetration depth, as seen in Fig. 4(c) (Multimedia view). Together, the flow visualization and PIV results (Figs. 4 and 5, respectively) highlight important safety aspects when considering aerosols dispersed by an individual's breathing. When not fitted with a mask, exhalation from the nose produces a relatively strong turbulent jet containing well mixed particles that will disperse relatively quickly away from the subject. While in the case of equipping a mask, the jet momentum is significantly reduced and redirected, leading to leakages of aerosols at any point where the mask does not maintain a tight seal to the face. Based on the results obtained here, the leakages are most significant at the bridge of the nose, leading to dense aerosol clouds exiting near and remaining close to the fore and top of the head.

C. Aerosol dispersion in an indoor environment

Noting the significance of both the ideal filtration characteristics (Sec. III A) and fit of a mask (Sec. III B), it is apparent that both effects must be taken into account in order to provide an accurate measure of the effectiveness of a mask in reducing the dispersion of an aerosol exhaled by an individual. This is investigated through the measurement of aerosol dispersion from the test model in a vacant indoor space over a period of 10 h, with the particle concentration measured at a 2 m distance from the subject [Fig. 2(a)], aligned with the widely accepted social distancing recommendations.

In an enclosed space with negligible convective effects, such as the room in which the tests are conducted, the concentration of

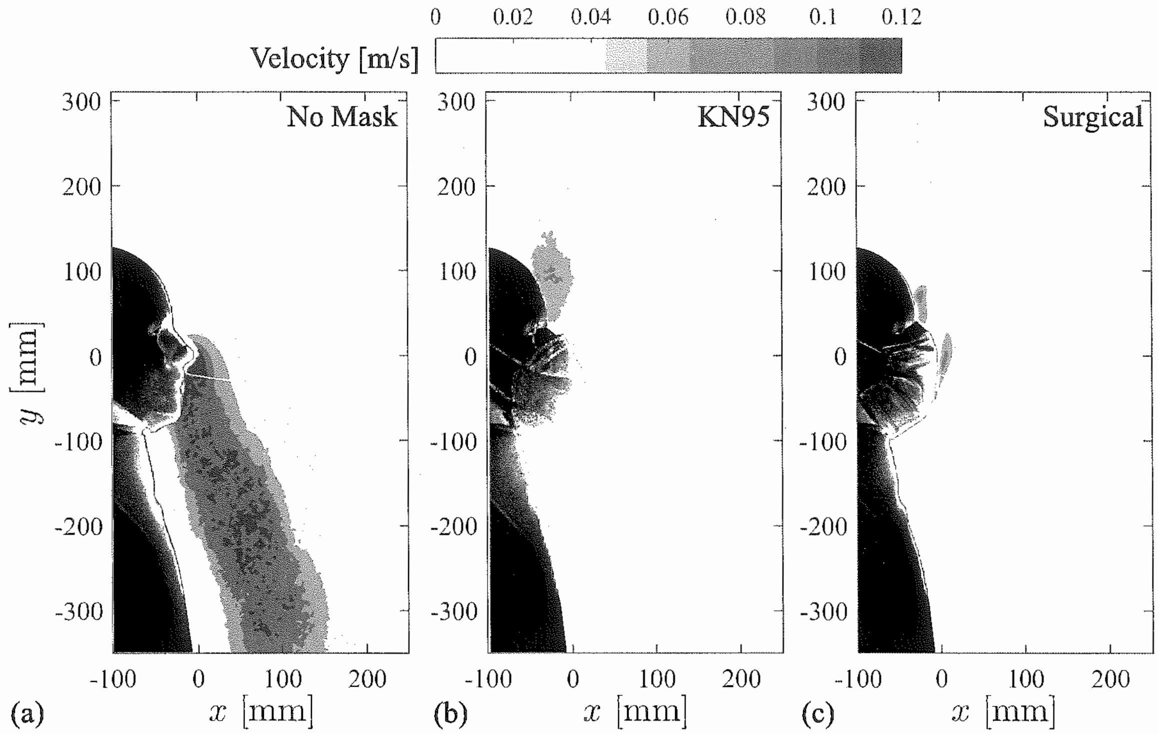

FIG. 5. Phase-averaged velocity fields at 180° within the breathing cycle for the (a) no mask, (b) KN95, and (c) surgical mask cases. Multimedia views: https://doi.org/10.1063/5.0057100.4; https://doi.org/10.1063/5.0057100.5; https://doi.org/10.1063/5.0057100.6

dispersed aerosols away from the source is governed by the unsteady diffusion equation

$$\frac{dc}{dt} = \nabla \cdot (K\nabla c) + R - \lambda c, \tag{1}$$

where c is the concentration of aerosol particles (particles m^{-3}), t is time, K is the diffusion coefficient ($m^2\ s^{-1}$), R is the particle injection rate (particles $m^{-3}\ s^{-1}$), and the sink term containing the decay rate λ (s^{-1}) which takes into account particle decay.[35]

While Eq. (1) has been used for modeling in a number of previous studies,[17,32,35,72] the model outcomes are predicated on appropriate estimation of the injection rate, decay, and diffusion terms, with the commonly employed coarse estimates only providing qualitative understanding of the spatial and temporal evolution of particle concentration for various room and source configurations. In practice, it is extremely challenging to obtain reasonable estimates for these values,[32] while computational results remain extremely sensitive to these parameters.

A significant simplification to Eq. (1) is commonly employed by assuming instantaneous distribution of produced aerosols in the room as in the following equation:

$$\frac{dc}{dt} = R - \lambda c. \tag{2}$$

The solution to Eq. (2), subject to the initial condition $c^*(t=0) = 0$, is given by

$$c^*(t) = \frac{R^*}{\lambda^*}(1 - e^{-\lambda^* t}). \tag{3}$$

For the purposes of practical data assimilation considered in the present study, the underlying simplification absorbs the effect of diffusion into the sink and source terms. This makes the solution dependent on the spatial location, and the relevant parameters are marked with an asterisk (c^*, R^*, λ^*). Equation (3) models the temporal evolution of concentration in a typical first-order fashion with a saturation concentration of $c^*_{sat} = R^*/\lambda^*$. Although previous studies have noted significant deviations of diffusion-based computational results from the well-mixed model,[72–74] the simplified model will be shown to fit well with the experimental data and thus provides a suitable comparison basis for saturation conditions. The latter allows for relative source strength comparisons between different test cases, which is of particular importance for the evaluation of the apparent mask filtration efficiency.

Experimental results from the aerosol dispersion tests are presented in Fig. 6, with results normalized by the average particle concentration of a single breath (Table I) and smoothed using a 10 min moving average. For clarity, the variability between repeated measurements is illustrated by the shaded regions only in the no-mask and KN95 cases, which are representative of the typical variability observed in all the tested cases. In Fig. 6(b), the results are also plotted on a logarithmic scale and fitted based on the typical first-order behavior described by Eq. (3). The obtained least squares fit parameters are presented in Table III, with the corresponding confidence intervals determined based on repeated tests.

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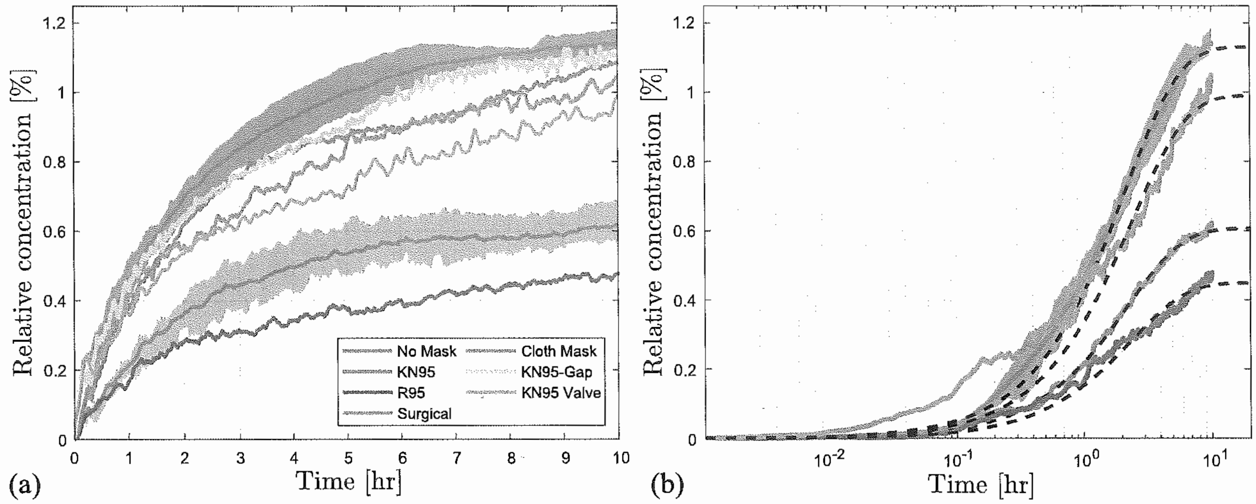

FIG. 6. Effect of various masks on the dispersion of aerosols measured at 2 m in front of the manikin. (a) Results are smoothed using a 10 min moving average. (b) Moving average particle concentration on semi-logarithmic scale for selected cases with a black dashed line showing model fits. Shaded areas show variability within repeated runs.

It can be seen that the simplified model captures the essential concentration trends well. The average relative concentration in the no-mask case is seen to asymptotically tend to the local steady state value of 1.13% of the breath particle concentration after a period of 10 h. Upon fitting various masks to the manikin, the relative concentrations are lowered in comparison to the no-mask case, indicating a reduction in the source strength due to filtration. The same is also captured in the reduction of the relative particle injection rate. However, the relative changes in the injection rate are significantly lower than those expected purely based on the ideal filtration efficiency of the mask material (Table II), which is attributed to the substantial aerosol leakage seen in Fig. 4.

Given close adherence of the experimental data to Eq. (3), the estimated saturated, i.e., steady state, concentration levels can be used to deduce the apparent filtration efficiency of the masks,

$$\eta_{\mathrm{AFE}} = 100 \times \left(\frac{c^*_{\mathrm{sat}_{\mathrm{NoMask}}} - c^*_{\mathrm{sat}}}{c^*_{\mathrm{sat}_{\mathrm{NoMask}}}} \right). \tag{4}$$

TABLE III. Apparent filtration characteristics of various masks based on particle dispersion tests over 10 h. R^* ((%/h) of the breath particle concentration) and λ^* (h^{-1}) are fit parameters estimated using a multi-variable least squares fit of Eq. (3) to the experimental data in Fig. 6. Values for the parameters are shown with a 95% confidence interval based on the t-statistic. Confidence interval on η_{AFE} incorporates the variation in the no-mask case.

Material	R^* (%h)	λ^* (h^{-1})	$c^*_{sat} = R^*/\lambda^*$ (%)	η_{AFE} (%)
No mask	0.53 ± 0.11	0.46 ± 0.11	1.13 ± 0.057	...
Cloth	0.45 ± 0.27	0.44 ± 0.31	1.02 ± 0.11	9.8 ± 9.7
Surgical	0.41 ± 0.36	0.41 ± 0.39	0.99 ± 0.11	12.4 ± 9.7
KN95	0.27 ± 0.10	0.45 ± 0.12	0.61 ± 0.095	46.3 ± 9.4
R95	0.19 ± 0.09	0.42 ± 0.11	0.45 ± 0.09	60.2 ± 9.0
KN95-gap	0.46 ± 0.16	0.42 ± 0.21	1.09 ± 0.09	3.4 ± 8.9
KN95-valve	0.37 ± 0.12	0.41 ± 0.14	0.90 ± 0.09	20.3 ± 8.9

The resulting estimates for the apparent filtration efficiency (η_{AFE}) are reported in Table III, which confirms that η_{AFE} for all the masks is significantly lower than the filtration efficiencies for their respective materials presented in Table II. The R95 mask has the highest η_{AFE} of 60.2%, which is attributed to the tighter fit of the mask obtained by the overhead straps, a relatively stiff fabric, and the built-in soft sealing layer at the nose bridge of the mask. For KN95 mask, the gaps along the cheeks and the nose bridge are found to be comparatively larger, which leads to a lower η_{AFE} despite a similar filtration efficiency of the material. The cloth and surgical masks perform relatively poorly with efficiencies of only 9.8% and 12.4%, respectively, due to both low material filtration efficiency and significantly higher amounts of leakages around the cheeks and bridge of the nose. Further, due to the higher flexibility of the cloth and surgical mask material, they easily deform during exhalation, causing an increase in the size of the preexisting gaps, allowing more aerosols to escape.

In order to further evaluate the effect of leakage through the gaps around the cheeks and the nose, a separate case with the KN95 mask was considered with 3 mm gaps created artificially, as described in Sec. II. The 3 mm gaps are representative of the typical gaps observed for the surgical and cloth masks and provide a "loose-fitting" KN95 case. Results for the KN95-gap case in Fig. 6 and Table III show a significant reduction in the filtration efficiency compared to the baseline KN95 mask, with η_{AFE} decreasing from 46.3% to a paltry 3.4%. This offers a holistic perspective on the implications of loose fitting masks and aerosol build-up, in contrast with the results of Sickbert-Bennet *et al.*[63] whose single-point measurement directly behind the mask shows an efficiency (FFE) of more than 90% with a sub-optimally fit N95 mask. An additional point of comparison is provided in the present study by an appropriately fitted KN95 mask equipped with a one-way valve, which has an apparent efficiency of approximately 20%. This illustrates that controlled discharge through a valve on a high-efficiency mask may lead to a better overall exhale filtration compared to either a lower-grade mask (cloth or surgical) or a loosely fitted high-efficiency mask.

An important aspect of mask usage that is not apparent in Fig. 6 due to temporal smoothing and averaging over repeated runs is illustrated in Fig. 7, which presents raw particle concentrations for a selected subset of test cases. The instantaneous particle concentrations measured within the field of view in Fig. 7(a) show large temporal variations in local concentrations when masks are used, which consistently exceed those seen for the no-mask case. The instantaneous magnitudes of particle concentrations reach up to 1.6% of the single breath concentration in the case of blue surgical mask, roughly 40% above the saturation concentration reached in the no-mask case. These maximum excursions in the cases of the KN95 and R95 masks are lower; however, the instantaneous spikes in concentration surpass the average no-mask concentration in the first hour of the test. These excursions in the local particle concentrations are attributed to the presence of dense particle clouds that frequently pass through the field of view, as illustrated in Fig. 7(b). The figure shows representative concentration maps of the particle clouds in the blue surgical and the KN95 mask cases. Peak concentrations reach up to 3% of the particle breath concentrations in the blue surgical mask case, which are localized within the core regions of the clouds and indicate a much higher threat than that perceived based on the averaged results in Fig. 6. Although these particle clouds were present in every tested case with a mask, their frequency and sizes decreased for masks with better fits and higher apparent filtration efficiencies (η_{AFE}), as illustrated by representative realizations for KN95 and R95 masks in Fig. 7(b). The implication for disease mitigation is a significant temporal variability in the exposure risk associated with masks in an unventilated indoor environment. Recent studies[72,73] have noted similar concentration excursions attributed to the local flows, exceeding the predictions based on the well-mixed and diffusion based models.

It is of practical interest to investigate the directivity of the exhaled particles for social distancing purposes in indoor environments with poor ventilation. Directivity of the particle dispersion at the 2 m distance from the source was investigated in the no-mask and KN95 cases, and the results are presented in Fig. 8. The results for the no-mask case in Fig. 8(a) show that the average concentrations reached at 90° and 180° decrease in comparison to those at 0°, but the effect of the orientation is less than 10%. In the case of KN95 mask [Fig. 8(b)], the particle concentrations at the non-zero orientations are only slightly higher than those at 0°. While the general trend highlighted by these results is in accordance with the expectations based on the flow visualization results (Fig. 4), the differences with orientation are relatively minor which indicates that the anticipated effect of directivity due to advection is primarily confined to the near vicinity of the source. In the absence of ventilation effects, turbulent diffusion appears to largely equalize the concentration along the circumferential direction at and beyond the 2 m radial distance surrounding the source. This is in accordance with the typical deposition mechanisms observed in the case of suspended particles.[75] However, the observed effect may be limited to relatively large room sizes, such as those used in the current experiment, where the advection effects near the source become negligible well inside the boundaries of the room. The current results are in qualitative agreement with the results from diffusion based models[35] in a poor ventilation scenario.

Finally, the effect of room ventilation and/or air cleaning is investigated on the aerosol dispersion 2 m in front of the manikin. Measurements are conducted at three different settings of a mobile air purifier installed in the corner of the room (left top corner in Fig. 1). Due to a high efficiency particle air (HEPA) filtration (>99% efficiency), the unit allows a controlled modeling of ventilation settings, with effective air-change rates (ACH) of 1.7, 2.45, and 3.2 h^{-1} considered in the present investigation. The results presented in Figs. 9(a) and 9(b) show a notable reduction in local concentration in front of the manikin even with relatively low effective air-change rates, as also noted by previous studies[35,75]) The measured concentrations are seen to decrease with increasing ACH, and the steady-state (c^*_{sat}) is achieved

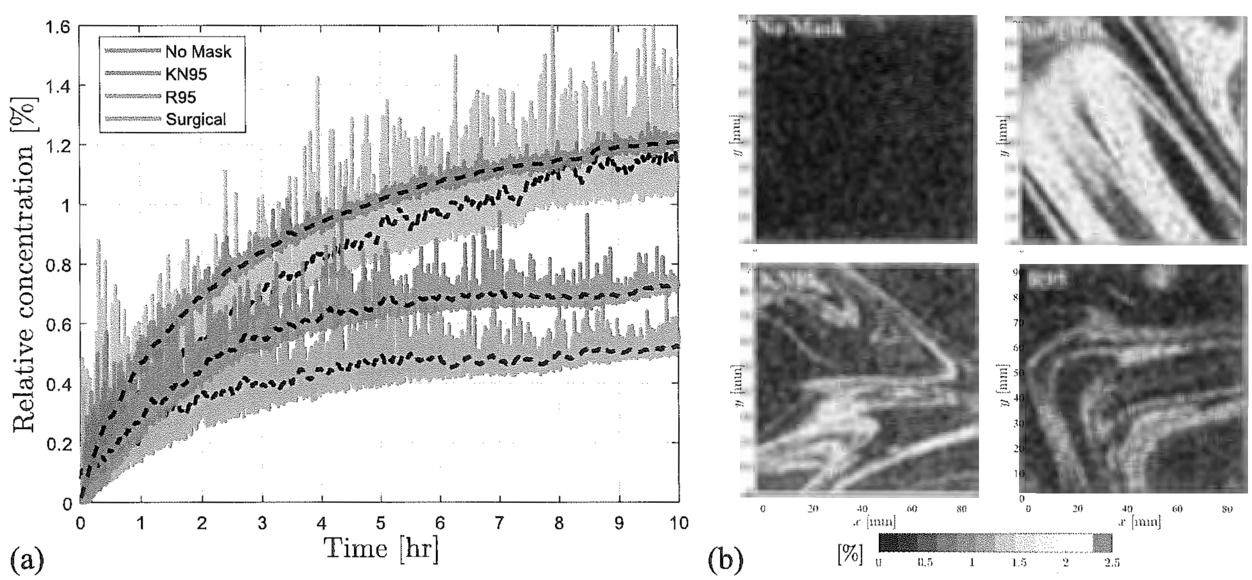

FIG. 7. (a) Raw particle concentration for representative test cases considered in Fig. 6 with moving average shown with black dashed lines. (b) Instantaneous relative particle concentration fields for the selected cases. Relative concentrations are represented as a fraction of the breath particle concentration.

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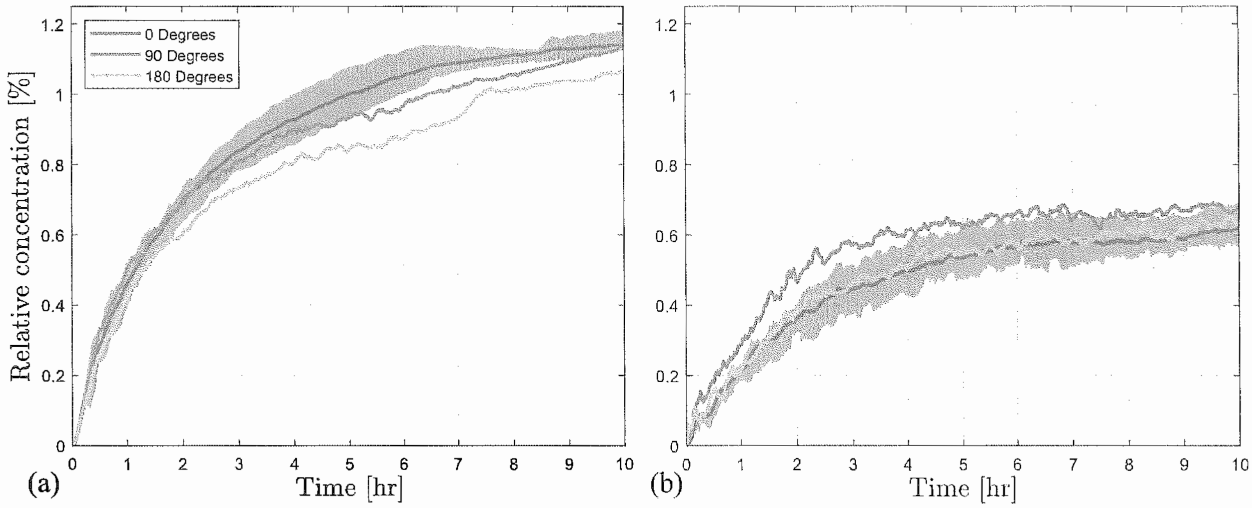

FIG. 8. Dispersion characteristics of the aerosols measured at a radius of 2 m from the manikin for (a) no mask and (b) KN95 mask.

within less than 4 h in all the air-cleaning cases. The results are fitted to the simplified model [Eq. (3)] in Fig. 9(b), and the fits are seen to approximate the data well. The corresponding fit parameters are summarized in Table IV. As expected, the increase in ACH results in a notable increase in the decay rate (λ^*), which is reflected in the earlier saturation of the local concentration. This is also in accordance with the increased diffusion coefficient in mixing ventilation scenarios as shown by Foat *et al.*[72] and Cheng *et al.*[75] at comparable ACH. The steady-state values are used to estimate an apparent filtration efficiency (η_{AFE}) of the system in order to draw meaningful comparisons with the results from the mask cases in an unventilated scenario. In this case, the apparent filtration efficiency (η_{AFE}) is obtained by the relative change in the steady-state concentration (c^*_{sat}) between the ventilated and unventilated cases. The results in Table IV show that the steady-state concentrations are decreased in the range 69%–84% for the considered cases and correspond to a much higher η_{AFE} compared with the best performing mask in an unventilated scenario (Table III). However, this also suggests that relatively low ventilation rates (ACH < 3.2 h^{-1}) may not be sufficient to reduce exposure to within acceptable levels at the typical social distancing guideline of 2 m, which supports the findings from previous studies.[73,77]

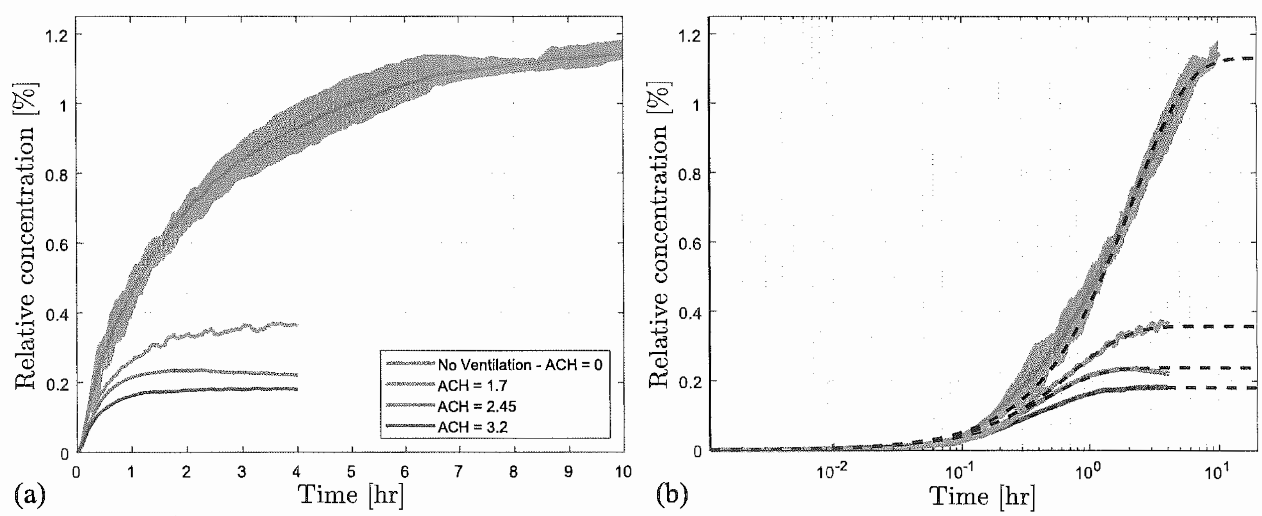

FIG. 9. Effect of ventilation on the dispersion characteristics of the aerosols measured at 2 m in front of the manikin without a mask on a (a) linear, and (b) logarithmic scale in time. Black dashed line indicates model fits to the moving average data.

TABLE IV. Apparent filtration efficiencies for various air-change rates (ACH) based on particle dispersion tests with no-mask. R^* ((%/h) of the breath particle concentration) and λ^* (h^{-1}) are fit parameters estimated using a multi-variable least squares fit of Eq. (3) to the experimental data in Fig. 9.

ACH	R^* (%/h)	λ^* (h^{-1})	$c^*_{sat} = R^*/\lambda^*$ (%)	η_{AFE} (%)
0	0.53	0.46	1.13	...
1.7	0.48	1.36	0.35	69
2.45	0.52	2.19	0.24	79
3.2	0.41	2.27	0.18	84

IV. CONCLUSIONS

The present study experimentally investigates the dispersion and accumulation of aerosol particles in indoor environments in the context of the guidelines proposed by national health agencies to control the transmission of COVID-19. Experiments were conducted in a controlled laboratory environment with a test manikin in a seated position mimicking relaxed exhalation through the nose, typical of an average adult. The manikin was equipped with five different commercially available masks that have seen widespread use throughout the course of the COVID-19 pandemic. Both near-field flow visualizations and far-field particle concentration measurements allow for a holistic investigation of the effect of masks and ventilation in the test room, and provide a quantitative measure relative to aerosol concentrations and mask efficiencies of interest for transmission risk assessment, model development, and implementation of adaptive health and safety practices at workplace. The results highlight that (i) considerable relative aerosol concentration levels can be reached at a 2 m distance from the subject in an unventilated space, and even when the subject is equipped with a mask, the relative concentrations are notably higher than those expected based on the ideal/rated efficiency of the masks; (ii) fit of the mask to the face, in terms of limiting leakage around the mask perimeter, is critical for limiting aerosol dispersion in an unventilated space, especially for high efficiency masks (e.g., N95/KN95); and (iii) increased ventilation/air-cleaning capacity significantly reduces the transmission risk in an indoor environment, surpassing the apparent mask filtration efficacy even at relatively low air-change rates ($\sim$2 room volumes per hour).

The baseline filtration characteristics for the various masks tested in this study indicate that more than 50% of aerosols (polydisperse, 1 μm mean diameter) can pass through the material of commercially available cloth and surgical masks in ideal conditions (zero leakage due to fit), whereas ideal filtration efficiency is 95% (or higher) in the case of KN95 and R95 masks. Flow visualizations and velocity measurements in the near-field (immediate vicinity of the face) indicate that none of the tested masks is performing at their ideal filtration efficiencies due to leakages through gaps in the fit of the mask. This occurs around the cheeks, below the jaw, and at the bridge of the nose, with the latter being the most significant for all masks. Aerosols are seen to escape through these leakage sites in the form of concentrated particle clouds that do not mix quickly with the ambient air on account of relatively low flow velocities and hence low levels of turbulent mixing. The degree of leakage varies between masks, with high-efficiency masks, such as the KN95, performing better. Factors affecting leakage at the mask perimeter include mask geometry, strap style and elasticity, and whether or not the mask is equipped with a deformable nose piece that can be tightly shaped to the nose. Furthermore, although the present study does not characterize the effectiveness of masks during inhalation, the aforementioned loss of filtration efficiency due to perimeter leakage is also expected to be present during inhalation, although it is to a lesser extent due to the improved sealing effect produced by the negative pressure difference relation to the ambient.

The near-field velocity measurements indicate that the forward momentum of breath exhaled through the nose is reduced significantly and redirected when the subject is equipped with a mask. Furthermore, this attenuation of the forward momentum increases with the filtration efficiency of the mask material when a proper fit is ensured. Thus, the present results endorse the use of high-efficiency, unvalved masks with a proper fit when the recommended social distancing guidelines cannot be maintained between individuals.

Measurements of aerosol concentration at a 2 m distance from the subject show a characteristic increase in average particle concentration with time in the absence of ventilation, following the first order response based on the well-mixed room model. Across all cases, relative particle concentrations saturate at elevated levels, indicating accumulation of aerosol particles within the room. When the subject is not fitted with a mask, the saturation concentration is the highest among all the cases tested. A decrease in saturation concentration is seen for all mask types; however, the effective filtration is notably lower than the ideal filtration efficiency of the material due to leakages in accordance with a mask's ability to decrease the number of particles released into the room per breath. Thus, the apparent filtration efficiency of a mask (η_{AFE}) is estimated based on the relative difference in saturation concentration at the measurement location between cases with and without a mask. This metric provides a more representative measure of mask efficiency and is of particular interest for future modeling studies and continuous occupancy risk assessment.

The results show that a standard surgical and three-ply cloth masks, which see current widespread use, filter at apparent efficiencies of only 12.4% and 9.8%, respectively. Apparent efficiencies of 46.3% and 60.2% are found for KN95 and R95 masks, respectively, which are still notably lower than the verified 95% rated ideal efficiencies. Furthermore, the efficiencies of a loose-fitting KN95 and a KN95 mask equipped with a one-way valve were evaluated, showing that a one-way valve reduces the mask's apparent efficiency by more than half (down to 20.3%), while a loose-fitting KN95 provides a negligible apparent filtration efficiency (3.4%). The present results provide an important practical contrast to many other previous experimental and numerical investigations, which do not consider the effect of mask fit when locally evaluating mask efficiency or incorporating mask usage in a numerical model. Nevertheless, if worn correctly, high-efficiency masks still offer significantly improved filtration efficiencies (apparent and ideal) over the more commonly used surgical and cloth masks, and hence are the recommended choice in mitigating the transmission risks of COVID-19.

The directivity of aerosol dispersion was assessed through concentration measurements at a 2 m distance and at locations in front of (0°), to the side of (90°), and behind (180°) the subject with a surgical and KN95 masks. For all the cases, the effect of orientation was less than about 10% of the local particle concentration and indicated a relatively minor directivity effect at a distance of 2 m. It is conjectured

based on the flow measurements in the vicinity of the manikin face that significant directivity effects are confined to the relatively close proximity of the host.

The effect of ventilation/air-cleaning was consider using a HEPA air purifier at the recommended pre-pandemic air-change rates (ACH = $1.7–3.2\,h^{-1}$). The results show that ventilation air-exchange or purification is effective in decreasing both the final saturation concentration and the time required to reach the saturation state. Based on the apparent filtration efficiency, tests performed with no mask at an air-change rate of $1.7\,h^{-1}$ (and higher) outperform cases with high-efficiency masks (KN95 and R95) and no room ventilation. However, at these low ventilation rates, a notable particle concentration is still present at a 2 m distance, which is indicative of higher ventilation rates needed to ensure negligible aerosol build-up over prolonged occupancy.

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DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author upon reasonable request.

REFERENCES

[1] L. Bourouiba, "The fluid dynamics of disease transmission," Annu. Rev. Fluid Mech. **53**, 473–508 (2021).

[2] R. Mittal, R. Ni, and J.-H. Seo, "The flow physics of COVID-19," J. Fluid Mech. **894**, F2 (2020).

[3] L. Bourouiba, "Turbulent gas clouds and respiratory pathogen emissions: Potential implications for reducing transmission of COVID-19," JAMA **323**, 1837–1838 (2020).

[4] S. Asadi, N. Bouvier, A. S. Wexler, and W. D. Ristenpart, "The coronavirus pandemic and aerosols: Does COVID-19 transmit via expiratory particles?" Aerosol. Sci. Technol. 54(6), 635–638 (2020).

[5] N. van Doremalen, T. Bushmaker, D. H. Morris, M. G. Holbrook, A. Gamble, B. N. Williamson, A. Tamin, J. L. Harcourt, N. J. Thornburg, S. I. Gerber, J. O. Lloyd-Smith, E. de Wit, and V. J. Munster, "Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1," N. Engl. J. Med. **382**, 1564–1567 (2020).

[6] S. W. X. Ong, Y. K. Tan, P. Y. Chia, T. H. Lee, O. T. Ng, M. S. Y. Wong, and K. Marimuthu, "Air, surface environmental, and personal protective equipment contamination by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) from a symptomatic patient," JAMA **323**, 1610–1612 (2020).

[7] S. Asadi, C. D. Cappa, S. Barreda, A. S. Wexler, N. M. Bouvier, and W. D. Ristenpart, "Efficacy of masks and face coverings in controlling outward aerosol particle emission from expiratory activities," Sci. Rep. **10**, 15665 (2020).

[8] S. Feng, C. Shen, N. Xia, W. Song, M. Fan, and B. J. Cowling, "Rational use of face masks in the COVID-19 pandemic," Lancet Respir. Med. **8**, 434–436 (2020).

[9] Y. Li, H. Qian, J. Hang, X. Chen, L. Hong, P. Liang, J. Li, S. Xiao, J. Wei, L. Liu *et al.*, "Evidence for probable aerosol transmission of SARS-CoV-2 in a poorly ventilated restaurant," MedRXiv (2020); accessed 13 July 2021.

[10] D. Lewis, "Is the coronavirus airborne? Experts can't agree," Nature **580**, 175 (2020).

[11] L. Morawska, J. W. Tang, W. Bahnfleth, P. M. Bluyssen, A. Boerstra, G. Buonanno, J. Cao, S. Dancer, A. Floto, F. Franchimon *et al.*, "How can airborne transmission of COVID-19 indoors be minimised?," Environ. Int. **142**, 105832 (2020).

[12] S. Y. Park, Y.-M. Kim, S. Yi, S. Lee, B.-J. Na, C. B. Kim, J.-I. Kim, H. S. Kim, Y. B. Kim, Y. Park *et al.*, "Coronavirus disease outbreak in call center, South Korea," Emerging Infect. Dis. **26**, 1666 (2020).

[13] H. Qian, T. Miao, L. Liu, X. Zheng, D. Luo, and Y. Li, "Indoor transmission of SARS-CoV-2," MedRXiv (2020).

[14] Centres for Disease Control and Prevention, "Scientific brief: SARS-CoV-2 and potential airborne transmission," *CDC COVID-19 Science Briefs* (Centres for Disease Control and Prevention, 2021); accessed 20 April 2021.

[15] World Health Organization, *Coronavirus Disease (COVID-19): How is it Transmitted?* (World Health Organization, 2021); accessed 2 May 2021.

[16] European Centre for Disease Prevention and Control, *Questions and Answers on COVID-19: Basic Facts* (European Centre for Disease Prevention and Control, 2021); accessed 2 May 2021.

[17] V. Vuorinen, M. Aarnio, M. Alava, V. Alopaeus, N. Atanasova, M. Auvinen, N. Balasubramanian, H. Bordbar, P. Erästö, R. Grande *et al.*, "Modelling aerosol transport and virus exposure with numerical simulations in relation to SARS-CoV-2 transmission by inhalation indoors," Safety Sci. **130**, 104866 (2020).

[18] R. Zhang, Y. Li, A. L. Zhang, Y. Wang, and M. J. Molina, "Identifying airborne transmission as the dominant route for the spread of COVID-19," Proc. Natl. Acad. Sci. **117**, 14857–14863 (2020).

[19] N. H. Leung, D. K. Chu, E. Y. Shiu, K.-H. Chan, J. J. McDevitt, B. J. Hau, H.-L. Yen, Y. Li, D. K. Ip, J. M. Peiris *et al.*, "Respiratory virus shedding in exhaled breath and efficacy of face masks," Nat. Med. **26**, 676–680 (2020).

[20] Y. Liu, Z. Ning, Y. Chen, M. Guo, Y. Liu, N. K. Gali, L. Sun, Y. Duan, J. Cai, D. Westerdahl *et al.*, "Aerodynamic analysis of SARS-CoV-2 in two Wuhan hospitals," Nature **582**, 557–560 (2020).

[21] C. R. MacIntyre, Q. Wang, S. Cauchemez, H. Seale, D. E. Dwyer, P. Yang, W. Shi, Z. Gao, X. Pang, Y. Zhang *et al.*, "A cluster randomized clinical trial comparing fit-tested and non-fit-tested N95 respirators to medical masks to prevent respiratory virus infection in health care workers," Influenza Respir. Viruses **5**, 170–179 (2011).

[22] M. Liang, L. Gao, C. Cheng, Q. Zhou, J. P. Uy, K. Heiner, and C. Sun, "Efficacy of face mask in preventing respiratory virus transmission: A systematic review and meta-analysis," Travel Med. Infect. Dis. **36**, 101751 (2020).

[23] A. Davies, K.-A. Thompson, K. Giri, G. Kafatos, J. Walker, and A. Bennett, "Testing the efficacy of homemade masks: Would they protect in an influenza pandemic?," Disaster Med. Public Health Preparedness **7**, 413–418 (2013).

[24] Y. Wang, H. Tian, L. Zhang, M. Zhang, D. Guo, W. Wu, X. Zhang, G. L. Kan, L. Jia, D. Huo *et al.*, "Reduction of secondary transmission of SARS-CoV-2 in households by face mask use, disinfection and social distancing: A cohort study in Beijing, China," BMJ Global Health **5**, e002794 (2020).

[25] J. Wu, F. Xu, W. Zhou, D. R. Feikin, C.-Y. Lin, X. He, Z. Zhu, W. Liang, D. P. Chin, and A. Schuchat, "Risk factors for SARS among persons without known contact with SARS patients, Beijing, China," Emerging Infect. Dis. **10**, 210 (2004).

[26] J. Howard, A. Huang, Z. Li, Z. Tufekci, V. Zdimal, H.-M. van der Westhuizen, A. von Delft, A. Price, L. Fridman, L.-H. Tang *et al.*, "An evidence review of face masks against COVID-19," Proc. Natl. Acad. Sci. **118**, e2014564118 (2021).

[27] Y. Li, G. M. Leung, J. Tang, X. Yang, C. Chao, J. Z. Lin, J. Lu, P. V. Nielsen, J. Niu, H. Qian *et al.*, "Role of ventilation in airborne transmission of infectious agents in the built environment—A multidisciplinary systematic review," Indoor Air **17**, 2–18 (2007).

[28] Z. T. Ai and A. K. Melikov, "Airborne spread of expiratory droplet nuclei between the occupants of indoor environments: A review," Indoor Air **28**, 500–524 (2018).

[29] P. V. Nielsen, "Control of airborne infectious diseases in ventilated spaces," J. R. Soc. Interface **6**, S747–S755 (2009).

[30] G. Sze To, M. Wan, C. Chao, F. Wei, S. Yu, and J. Kwan, "A methodology for estimating airborne virus exposures in indoor environments using the spatial distribution of expiratory aerosols and virus viability characteristics," Indoor Air **18**, 425–438 (2008).

[31] E. Bjørn and P. V. Nielsen, "Dispersal of exhaled air and personal exposure in displacement ventilated rooms," Indoor Air **12**, 147–164 (2002).

[32] R. K. Bhagat, M. D. Wykes, S. B. Dalziel, and P. Linden, "Effects of ventilation on the indoor spread of COVID-19," J. Fluid Mech. **903**, F1 (2020).

[33] R. Mittal, C. Meneveau, and W. Wu, "A mathematical framework for estimating risk of airborne transmission of COVID-19 with application to face mask use and social distancing," Phys. Fluids **32**, 101903 (2020).

[34] E. Riley, G. Murphy, and R. Riley, "Airborne spread of measles in a suburban elementary school," Am. J. Epidemiol. **107**, 421–432 (1978).

[35] Z. Lau, K. Kaouri, and I. M. Griffiths, "Modelling airborne transmission of COVID-19 in indoor spaces using an advection-diffusion-reaction equation," arXiv:2012.12267 (2020).

[36] B. Blocken, T. van Druenen, A. Ricci, L. Kang, T. van Hooff, P. Qin, L. Xia, C. A. Ruiz, J. Arts, J. Diepens *et al.*, "Ventilation and air cleaning to limit aerosol particle concentrations in a gym during the COVID-19 pandemic," Build. Environ. **193**, 107659 (2021).

[37] C. K. Ho, "Modelling airborne transmission and ventilation impacts of a COVID-19 outbreak in a restaurant in Guangzhou, China," Int. J. Comput. Fluid Dyn. **35**, 1–19 (2021).

[38] G. Buonanno, L. Stabile, and L. Morawska, "Estimation of airborne viral emission: Quanta emission rate of SARS-CoV-2 for infection risk assessment," Environ. Int. **141**, 105794 (2020).

[39] S. Shao, D. Zhou, R. He, J. Li, S. Zou, K. Mallery, S. Kumar, S. Yang, and J. Hong, "Risk assessment of airborne transmission of COVID-19 by asymptomatic individuals under different practical settings," J. Aerosol Sci. **151**, 105661 (2021).

[40] A. Khosronejad, C. Santoni, K. Flora, Z. Zhang, S. Kang, S. Payabvash, and F. Sotiropoulos, "Fluid dynamics simulations show that facial masks can suppress the spread of COVID-19 in indoor environments," AIP Adv. **10**, 125109 (2020).

[41] G. R. Johnson and L. Morawska, "The mechanism of breath aerosol formation," J. Aerosol Med. Pulm. Drug Delivery **22**, 229–237 (2009).

[42] K. E. Barrett, S. M. Barman, S. Boitano, and H. L. Brooks, *Ganong's Review of Medical Physiology*, 24th ed. (McGraw-Hill, 2012).

[43] C. Kähler, B. Sammler, and J. Kompenhans, "Generation and control of tracer particles for optical flow investigations in air," Exp. Fluids **33**, 736–742 (2002).

[44] R. S. Papineni and F. S. Rosenthal, "The size distribution of droplets in the exhaled breath of healthy human subjects," J. Aerosol Med. **10**, 105–116 (1997).

[45] H. Holmgren, E. Ljungström, A.-C. Almstrand, B. Bake, and A.-C. Olin, "Size distribution of exhaled particles in the range from 0.01 to 2.0 μm," J. Aerosol Sci. **41**, 439–446 (2010).

[46] X. Xie, Y. Li, A. Chwang, P. Ho, and W. Seto, "How far droplets can move in indoor environments–revisiting the wells evaporation–falling curve," Indoor Air **17**, 211–225 (2007).

[47] R. Durscher and S. Roy, "Evaluation of thrust measurement techniques for dielectric barrier discharge actuators," Exp. Fluids **53**, 1165–1176 (2012).

[48] J. Wei and Y. Li, "Airborne spread of infectious agents in the indoor environment," Am. J. Infect. Control **44**, S102–S108 (2016).

[49] C. Fairchild and J. Stampfer, "Particle concentration in exhaled breath," Am. Ind. Hyg. Assoc. J. **48**, 948–949 (1987).

[50] A. A. Zaidi, B. C. Mattern, P. Claes, B. McEcoy, C. Hughes, and M. D. Shriver, "Investigating the case of human nose shape and climate adaptation," PLOS Genet. **13**, e1006616 (2017).

[51] R. J. Adrian and J. Westerweel, *Particle Image Velocimetry* (Cambridge University Press, 2011).

[52] A. Weber, K. Willeke, R. Marchloni, T. Myojo, R. Mckay, J. Donnelly, and F. Liebhaber, "Aerosol penetration and leakage characteristics of masks used in the health care industry," Am. J. Infect. Control **21**, 167–173 (1993).

[53] A. L. Sanchez, J. A. Hubbard, J. G. Dellinger, and B. L. Servantes, "Experimental study of electrostatic aerosol filtration at moderate filter face velocity," Aerosol Sci. Technol. **47**, 606–615 (2013).

[54] E. S. Moyer and M. Bergman, "Electrostatic N-95 respirator filter media efficiency degradation resulting from intermittent sodium chloride aerosol exposure," Appl. Occup. Environ. Hyg. **15**, 600–608 (2000).

[55] H. Jung, J. K. Kim, S. Lee, J. Lee, J. Kim, P. Tsai, C. Yoon *et al.*, "Comparison of filtration efficiency and pressure drop in anti-yellow sand masks, quarantine masks, medical masks, general masks, and handkerchiefs," Aerosol Air Qual. Res. **14**, 991–1002 (2013).

[56] A. Konda, A. Prakash, G. A. Moss, M. Schmoldt, G. D. Grant, and S. Guha, "Aerosol filtration efficiency of common fabrics used in respiratory cloth masks," ACS Nano **14**, 6339–6347 (2020).

[57] S. N. Rogak, T. A. Sipkens, M. Guan, H. Nikookar, D. Vargas Figueroa, and J. Wang, "Properties of materials considered for improvised masks," Aerosol Sci. Technol. **55**, 398–413 (2021).

[58] B. Maher, R. Chavez, G. C. Tomaz, T. Nguyen, and Y. Hassan, "A fluid mechanics explanation of the effectiveness of common materials for respiratory masks," Int. J. Infect. Dis. **99**, 505–513 (2020).

[59] M. Zhao, L. Liao, W. Xiao, X. Yu, H. Wang, Q. Wang, Y. L. Lin, F. S. Kilinc-Balci, A. Price, L. Chu *et al.*, "Household materials selection for homemade cloth face coverings and their filtration efficiency enhancement with triboelectric charging," Nano Lett. **20**, 5544–5552 (2020).

[60] J. N. Hancock, M. J. Plumley, K. Schilling, D. Sheets, and L. Wilen, "Comment on 'aerosol filtration efficiency of common fabrics used in respiratory cloth masks'," ACS Nano **14**, 10758–10763 (2020).

[61] S. Verma, M. Dhanak, and J. Frankenfield, "Visualizing the effectiveness of face masks in obstructing respiratory jets," Phys. Fluids **32**, 061708 (2020).

[62] C. J. Kähler and R. Hain, "Fundamental protective mechanisms of face masks against droplet infections," J. Aerosol Sci. **148**, 105617 (2020).

[63] I. M. Viola, B. Peterson, G. Pisetta, G. Pavar, H. Akhtar, F. Menoloascina, E. Mangano, K. E. Dunn, R. Gabl, A. Nila, E. Molinari, C. Cummins, G. Thompson, T.-Y. M. Lo, F. C. Denison, P. Digard, O. Malik, M. J. G. Dunn, C. M. McDougall, and F. V. Mehendale, "Face coverings, aerosol dispersion and mitigation of virus transmission risk," IEEE Open J. Eng. Med. Biol. **2**, 26–35 (2021).

[64] V. Arumuru, J. Pasa, and S. S. Samantaray, "Experimental visualization of sneezing and efficacy of face masks and shields," Phys. Fluids **32**, 115129 (2020).

[65] E. E. Sickbert-Bennett, J. M. Samet, P. W. Clapp, H. Chen, J. Berntsen, K. L. Zeman, H. Tong, D. J. Weber, and W. D. Bennett, "Filtration efficiency of hospital face mask alternatives available for use during the COVID-19 pandemic," JAMA Internal Med. **180**, 1607–1612 (2020).

[66] E. E. Sickbert-Bennett, J. M. Samet, S. E. Prince, H. Chen, K. L. Zeman, H. Tong, and W. D. Bennett, "Fitted filtration efficiency of double masking during the COVID-19 pandemic," JAMA Internal Med. (published online 2021).

[67] Q. Zhang and H. Johari, "Effects of acceleration on turbulent jets," Phys. Fluids **8**, 2185–2195 (1996).

[68] R. A. Fjeld and T. M. Owens, "The effect of particle charge on penetration in an electret filter," IEEE Trans. Ind. Appl. **24**, 725–731 (1988).

[69] R. E. Shaffer and S. Rengasamy, "Respiratory protection against airborne nanoparticles: A review," J. Nanopart. Res. **11**, 1661–1672 (2009).

[70] J. Kim, W. J. Jasper, and J. P. Hinestroza, "Charge characterization of an electrically charged fiber via electrostatic force microscopy," J. Eng. Fibers Fabr. **1**, 30–46 (2006).

[71] L. W. Barrett and A. D. Rousseau, "Aerosol loading performance of electret filter media," Am. Ind. Hyg. Assoc. J. **59**, 532–539 (1998).

[72] T. Foat, J. Drodge, J. Nally, and S. Parker, "A relationship for the diffusion coefficient in eddy diffusion based indoor dispersion modelling," Build. Environ. **169**, 106591 (2020).

[73] B. Birnir and L. Angheluta, "The build-up of droplet/aerosols carrying the SARS-CoV-2 coronavirus, in confined spaces," medRxiv (2020).

[74] T. Yamamoto, D. S. Ensor, and L. E. Sparks, "Evaluation of ventilation performance for indoor space," Build. Environ. **29**, 291–296 (1994).

[75] S. Friedlander and H. Johnstone, "Deposition of suspended particles from turbulent gas streams," Ind. Eng. Chem. **49**, 1151–1156 (1957).

[76] K.-C. Cheng, V. Acevedo-Bolton, R.-T. Jiang, N. E. Klepeis, W. R. Ott, O. B. Fringer, and L. M. Hildemann, "Modeling exposure close to air pollution sources in naturally ventilated residences: Association of turbulent diffusion coefficient with air change rate," Environ. Sci. Technol. **45**, 4016–4022 (2011).

[77] J. A. Lednicky, M. Lauzard, Z. H. Fan, A. Jutla, T. B. Tilly, M. Gangwar, M. Usmani, S. N. Shankar, K. Mohamed, A. Eiguren-Fernandez *et al.*, "Viable SARS-CoV-2 in the air of a hospital room with COVID-19 patients," Int. J. Infect. Dis. **100**, 476–482 (2020).

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Aerosol filtration efficiency of household materials for homemade face masks: Influence of material properties, particle size, particle electrical charge, face velocity, and leaks

Frank Drewnick [a], Julia Pikmann [a], Friederike Fachinger [a], Lasse Moormann [a], Fiona Sprang [a], and Stephan Borrmann [a,b]

[a] Particle Chemistry Department, Max Planck Institute for Chemistry, Mainz, Germany; [b] Institute for Atmospheric Physics, Johannes Gutenberg University, Mainz, Germany

ABSTRACT

As a consequence of the COVID-19 pandemic caused by the SARS-CoV-2 virus, the widespread daily use of face masks is promoted worldwide. Particle-size dependent filtration efficiencies (*FE*; d_p = 30 nm–10 µm), applying a particle counting approach, and additionally pressure drops (Δp) were determined for 44 samples of household materials and several medical masks. Huge *FE* differences were found between sample materials and for different particle sizes, spanning from <10% up to almost 100%. Minimum *FE* were determined for d_p = 50–500 nm particles with significantly larger values for d_p = 30 nm particles and especially for those with d_p > 2.5 µm. Measurements at different numbers of layers showed that stacks of textiles can be treated as separate filters and total *FE* and Δp can readily be estimated from the features of the individual layers, leaving laborious measurements of individual combinations obsolete. For many materials, electrostatic attraction contributes strongly to overall *FE* for particles up to 100 nm diameter. Measurements with defined leaks showed that already a small fractional leak area of 1–2% can strongly deteriorate total *FE*. This is especially the case for particles smaller than 5 µm diameter, where *FE* dropped by 50% or even two thirds. Our measurements show that by stacking an adequate number of layers of many fabrics, decent filtration efficiencies can be reached for homemade face masks over large particle size ranges with acceptable pressure drop across the material. Very important, however, is good fit of the masks to minimize leak flows and selection of non-hazardous mask material.

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EDITOR
Jing Wang

CONTACT Frank Drewnick frank.drewnick@mpic.de Particle Chemistry Department, Max-Planck-Institute for Chemistry, Hahn-Meitner-Weg 1, D-55128 Mainz, Germany

Supplemental data for this article can be accessed here.

1. Introduction

Within months, the current coronavirus disease 2019 (COVID-19) pandemic has spread over the whole planet. As a consequence of this massive outbreak, social and economic life is severely affected in many countries (Leopoldina – German National Academy of Sciences 2020) due to a combination of widespread lockdowns as well as physical and social distancing measures, recommended or enforced by national health authorities and politics (Zhang et al. 2020).

COVID-19 spreads via transmission of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), involving virus-containing respiratory fluids and saliva (WHO 2020a). The World Health Organization (WHO) has suggested that the primary transmission modes of SARS-CoV-2 are person-to-person transmission (i.e., droplet transmission) and contact with contaminated surfaces (WHO 2020a, 2020c). The rapid spread of the virus as well as various studies, e.g., showing transmission over distances >1–2 m (Li et al. 2020), however, suggest that also other routes of transmission such as airborne transmission may play an important role (Hadei et al. 2020; van Doremalen et al. 2020; Morawska and Milton 2020; Zhang et al. 2020). The corresponding details, however, are not completely known yet (Morawska and Milton 2020; Zhang et al. 2020; Hadei et al. 2020; Klompas, Baker, and Rhee 2020).

Droplet transmission is based on respiratory droplets, which, according to WHO convention (Gralton et al. 2011; WHO 2014; Kutter et al. 2018), have a diameter (d_p) of 5 µm and larger. Contact (or fomite) transmission can occur via deposition of virus-containing respiratory fluids on surfaces when they are touched by a person who subsequently touches the own nose, mouth, or eyes (WHO 2014). In airborne (or aerosol) transmission, the virus is transported via droplet nuclei or smaller aerosol particles ($d_p \leq 5$ µm) suspended in air (WHO 2014), which can stay suspended in air over extended periods of time (Hinds 1999). Airborne transmission requires that the virus

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remains infectious in droplet nuclei over extended time periods. This is known to be the case for pathogens causing pulmonary tuberculosis, measles, or chickenpox (WHO 2014), however, also for SARS-CoV-2 viability in aerosol particles over more than an hour has been demonstrated (van Doremalen et al. 2020).

Exhaled respiratory particles cover a particle size range from $d_p = 0.01$ µm up to 1000 µm (Gralton et al. 2011; Bake et al. 2019 and references therein), generated by coughing and sneezing, but also during speaking and regular breathing (Chao et al. 2009; Morawska et al. 2009; Johnson et al. 2011; Bake et al. 2019). Breathing generates the smallest particles (typically $d_p < 4$ µm) with a mode diameter around 0.8 µm, caused by fluid film burst during airway reopening (Bake et al. 2019; Johnson et al. 2011), with particle concentrations increasing with exhalation depth (Bake et al. 2019). Slightly larger particles were observed from whispering and speaking, with more particles being generated from voiced activities than from whispered (Morawska et al. 2009). These particles as well as those from coughing are generated by vocal cord vibrations and aerosolization in the laryngeal region; their count mode diameters were found to be around $d_p = 1$ µm (Johnson et al. 2011) or 6 µm (Chao et al. 2009). Their concentrations were found to be an order of magnitude higher than those from breathing (Morawska et al. 2009), increasing with speech loudness (Asadi et al. 2019). Much larger droplets are generated in the upper respiratory tract during speaking, coughing, and sneezing with d_p around 200 µm (Johnson et al. 2011).

The fate and hazardousness of potentially virus-containing droplets after exhalation strongly depends on their size. Small droplets, smaller than several tens of µm, evaporate within seconds (Morawska et al. 2009; Gralton et al. 2011; Parienta et al. 2011; Chaudhuri et al. 2020), leaving droplet nuclei of 30–50% of their initial diameter, depending on the amount of dissolved material. Droplet nuclei with $d_p < 10$ µm can remain airborne over extended periods of time and can be inhaled, with smaller particles reaching deeper regions of the respiratory system (Oberdörster, Oberdörster, and Oberdörster 2005). Very large droplets, $d_p > 100$ µm, sediment quickly and are mostly deposited on a surface before they evaporate (Chaudhuri et al. 2020). The number of virions within a single respiratory particle depends on the virus titer in the source region and increases with the cube of the particle diameter. With SARS-CoV-2 viral loads of $4.6 \cdot 10^5$ copies per mL of nasopharyngeal sample (Bae et al. 2020), about 20% of exhaled 100 µm diameter droplets would contain a virion; for 10 µm droplets only 2 out of 10,000 particles would contain a virion and for $d_p = 1$ µm droplets this fraction would be another 1000 times smaller.

To prevent transmission of COVID-19, the wearing of face masks in addition to thorough hand hygiene and physical distancing is advised (e.g., WHO 2020b; Leopoldina – German National Academy of Sciences 2020). Health workers are recommended to wear a surgical mask, certified according to a set of test methods like European standard EN 14683, or filtering facepiece respirators (FFR), certified for filtration efficiency and seal leakage rate according to test procedures like European standard EN 149 (e.g., FFP2), which protect the wearer (Lee, Grinshpun, and Reponen 2008; Oberg and Brosseau 2008). Under conditions of severe medical mask supply shortage, the use of cloth masks is recommended for the general public only (WHO 2020b).

The massive demand for medical masks during the first months of the pandemic caused shortage of supply of such devices in many countries. Therefore, numerous people make their own cloth masks using various kinds of available fabrics. In addition, new suppliers of simple cloth masks mushroom, frequently offering masks of questionable filtration efficiency and quality. Furthermore, in many countries suffering from poor air quality, people wear simple cloth masks to protect themselves from particulate air pollution (Shakya et al. 2017; Neupane et al. 2019), known to cause various adverse health effects (Jacobson 2012; WHO 2016).

Particle removal from an airstream is caused by five physical mechanisms: interception, inertial impaction, gravitational settling, diffusion, and electrostatic attraction (Hinds 1999). While the first three mechanisms increase in efficiency with increasing particle size, the latter two are more efficient for smaller particles. This results in typical filtration efficiency curves with a minimum for particles of around 0.05 µm to 0.5 µm diameter (most penetrating particle size, Hinds 1999). Larger face velocities cause an increase of deposition by impaction, however, gravitational settling, diffusion, and electrostatic attraction become less efficient under such conditions.

Both applications of cloth masks, protection from respiratory disease transmission and from particulate air pollution, require the removal of particles within a large size range. Exhaled respiratory particles range in diameter from 0.01 µm to 1000 µm (Bake et al. 2019) with particles smaller than ~10 µm in diameter being respirable. Urban air pollution contains ultrafine particles ($d_p < 100$ nm), e.g., diesel soot particles, fine particles ($d_p < 1$ µm) with secondary pollutants, as well as coarse particles ($d_p > 1$ µm), often consisting of mineral dust and sea salt (e.g., Jacobson 2012 and references therein).

Several studies on filtration efficiency of simple cloth masks or fabrics which can be used to make such masks can be found in the literature (Rengasamy, Eimer, and Shaffer 2010; Davies et al. 2013; Shakya et al. 2017; Neupane et al. 2019; Konda et al. 2020; Lustig et al. 2020). These studies present results only for a very limited variety of materials with no or only little systematic investigation of factors influencing particle filtration efficiency. Therefore, in order to support the selection of adequate materials for making cloth face masks and to better understand which factors affect mask efficacy, we performed systematic measurements of particle size-resolved (d_p = 30 nm–10 µm) filtration efficiency and of pressure drop for 44 typical household materials and several medical masks under different experimental conditions, including different face velocities, number of sample layers, and leaks.

2. Methods and materials

Filtration efficiency of sample materials was determined by measuring particle transmission through the respective samples, applying different particle counting methods: the *CPC setup* (Condensation Particle Counter setup) for measurement of electrically charged and neutralized aerosol particles in the diameter range from 30 nm up to 500 nm; and the *SMPS/OPC setup* (Scanning Mobility Particle Sizer/Optical Particle Counter setup) using ambient aerosol particles (d_p = 30 nm–10 µm).

2.1. Design of the CPC setup

The *CPC setup* is presented schematically in Figure 1a. NaCl aerosol is generated using a nebulizer (model 3076, TSI, Inc.) and a silica gel diffusion dryer. A differential mobility analyzer (DMA, model 3081, with X-ray aerosol neutralizer model 3088, both TSI, Inc.) is used to generate monodisperse aerosol of the desired d_p. Note that this provides mobility particle diameter (i.e., $d_p = d_{mob}$), which is used throughout this article. The resulting aerosol is either directly used ("charged aerosol") or it is directed through an additional aerosol neutralizer (model 5522-A, Grimm Aerosoltechnik) to bring the aerosol into the natural charge equilibrium again ("neutralized aerosol"). After dilution with particle-free air and turbulent mixing of sample and dilution flow in a 15 cm long piece of ¼" tubing the aerosol passes the sample (i.e., the mask or cloth material), fixed in a sample holder (ID = 65 mm). The flow through the sample is maintained using a vacuum pump (model V-VTE-10, Rietschle) and an adjustable valve and measured using a thermal mass flow meter (model 4043, TSI, Inc.). In front of and behind the sample holder, partial flows of the aerosol are diverted to two water-based CPCs (model 3787, TSI, Inc.) in order to measure respective particle number concentrations. The pressure difference across the sample is measured using a differential pressure sensor (model testo 440 dP, Testo SE & Co. KGaA).

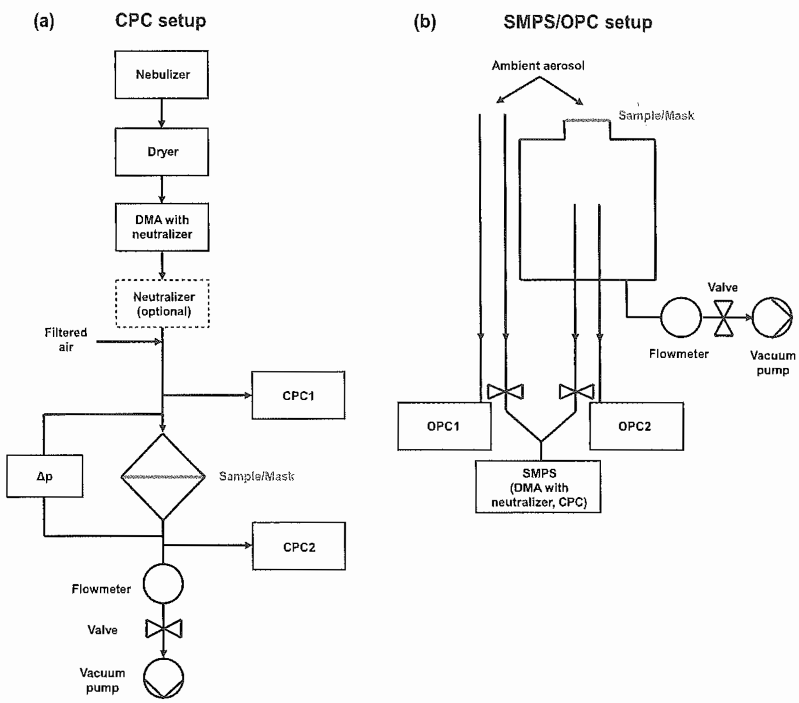


Figure 1. Experimental setups: (a) *CPC setup*, (b) *SMPS/OPC setup*.

2.2. Design of the SMPS/OPC setup

For measurement of filtration efficiencies for particles up to d_p = 10 µm, the *SMPS/OPC setup* (Figure 1b) was adopted, using ambient aerosol, which entered the room through an open gate. The aerosol was drawn through the sample, which was fixed onto a flange (ID = 70 mm) on the top of a 20-liter flow chamber. The flow was maintained using a vacuum pump (model SH-110, Varian, Inc.) connected to the bottom of the flow chamber in combination with an adjustable valve and a thermal mass flow meter (model 4043, TSI, Inc.). Particle size distributions in the diameter range from 250 nm up to more than 10 µm were measured simultaneously with two OPCs (model 1.109, Grimm Aerosoltechnik). The two instruments used vertical inlet lines (l = 50 cm) with inlet openings in the center of the flow chamber and next to the flow chamber inlet in ambient air, respectively. In addition, particle size distributions (d_p = 20 nm–450 nm) were measured using a single SMPS system, alternating between two inlet lines with openings in and next to the flow chamber. The SMPS consisted of an X-ray aerosol neutralizer (model 3088, TSI, Inc.), an electrostatic classifier (model 3082, TSI, Inc.) with a differential mobility analyzer (model 3081A, TSI, Inc.), and a nano water-based CPC (model 3788, TSI, Inc.).

2.3. Sample materials

A total of 48 different sample materials were investigated:

- twelve pure cotton fabrics, including woven textiles with different thread counts as well as jersey and velvet cotton,
- five fabrics containing cotton mixed with synthetics, including flannel, French terry, and velour,
- eleven synthetic fiber samples including woven and jersey materials,
- four paper-like materials (paper towels, coffee filter, paper tissue),
- four natural fiber materials (linen, wool, silk),
- eight synthetic household materials such as vacuum cleaner bags, a vacuum cleaner bag backup filter, anti-allergic mattress and linen encasements, and polyurethane (PU) foams,
- three commercially available surgical masks (EN 14683) and one FFP2 mask (EN 149); a separate surgical mask (EN 14683) was used for the measurements of the influence of leaks on filtration efficiency.

A list of all sample materials with details like thread count, material area density, and composition is provided in the supplementary information (SI, Table S1). As customary in the textile industry, for woven materials, thread count was determined as the sum of warp and filling threads in one square inch of the textile. For knitted materials, we determined an estimate of the thread count by counting the number of stitches along the base and the height of the same square and multiplication by three to account for the number of threads confining each stitch. Material area density (in g m^{-2}) was determined by weighing a 20 mm diameter punch of the material and expanding this value to the mass per square meter. For the analysis, both numbers were multiplied with the numbers of layers of the material used for the measurements. When mounting stretchable fabrics in the sample holder, special care was taken not to expand them.

3. Test procedure and analysis

3.1. Measurements and data analysis for the CPC setup

One CPC measured upstream and one downstream the sample for 30 s (1-s time resolution), then the CPCs were swapped for another 30 s measurement to account for potential instrumental differences. The transmission T was calculated as the geometric mean of the ratio of measured downstream to upstream concentrations of both measurements, and corrected for setup-inherent particle losses by multiplying with an experimentally determined correction factor of 0.99. Each measurement was divided into three subsets and repeated three times with freshly mounted sample material, resulting in a total of nine measurements of which the average and as measurement uncertainty the 1-sigma standard deviation of the average were calculated. All measurements were performed with particles of 30 nm, 50 nm, 100 nm, 250 nm, and 500 nm diameter, for both charged and neutralized aerosol, at two flow rates which correspond to face velocities at the filter of 5.3 cm s^{-1} and 12.9 cm s^{-1}, respectively. For more details, see SI (Section S1).

Pressure drop Δp across the sample was measured threefold after stabilization of the reading and corrected for the flow resistance of the tubes between the pressure gauge connections, determined at the same flow with no sample installed. Uncertainty of Δp was typically 1 Pa.

3.2. Measurement and data analysis for the SMPS/OPC setup

After 5 min equilibration time, SMPS and OPC measurements were performed in parallel: while the two OPCs sampled for ~20 min at 6-s time resolution filtered and ambient air, respectively, providing three subsets of ~7 min each, the SMPS was switched between the two air flows after each 150 s scan, resulting in three ambient/filtered air sample pairs per measurement. This measurement was repeated three times with a newly mounted sample, providing nine individual values of filtration efficiency in total. Size-resolved filtration efficiencies FE (defined as $FE[\%] = 100 \cdot (1 - T)$, with transmission T the ratio of average particle number concentration at a given diameter measured in filtered to that in ambient air) were calculated individually from the SMPS and OPC measurements. Afterwards they were merged to a single filtration efficiency curve. From this curve, FE for the chosen particle diameters (30 nm, 50 nm, 100 nm, 250 nm, 500 nm, 1 μm, 2.5 μm, 5 μm, and 10 μm) were obtained. Instrumental differences between the OPCs were accounted for by applying an experimentally determined size-dependent correction factor. All measurements were performed at the two face velocities also used in the *CPC setup*. More details are provided in the SI (Section S2).

In addition to the standard deviation of the average, also the uncertainty due to counting statistics (dominating uncertainty at low particle number concentrations) was calculated for each particle size. Provided in the results section are always the larger of the two uncertainty values.

4. Results

4.1. Overview of filtration efficiencies of masks and potential mask materials

Exemplary filtration efficiency curves for both face velocities are shown in Figure 2 for jersey (2 layers), velvet polyester, vacuum cleaner bag (#2), and silk (thin). Filtration efficiency curves for all materials are shown in the SI (Figures S1–S7). As expected from filtration theory (see Section 1; Hinds 1999), a minimum in *FE* is found between 50 nm and 500 nm for all samples. More efficient diffusion and electrostatic attraction for smaller particles, and interception, impaction, and gravitational settling for larger particles result in larger *FE* toward both ends of the probed size range. The absolute level of filtration efficiencies for particles of individual diameters as well as the diameter of minimum efficiency depend on the respective efficiencies of the various deposition mechanisms. For increased face velocity, diffusion and electrostatic attraction (mainly affecting very small particles) are less effective while impaction (mainly affecting large particles) is more effective. This causes a shift of the diameter of minimum *FE* toward smaller particles, reduced *FE* values for very small particles, and increased *FE* for the larger particles for higher face velocity (Figure 2 and SI Figures S1–S7).

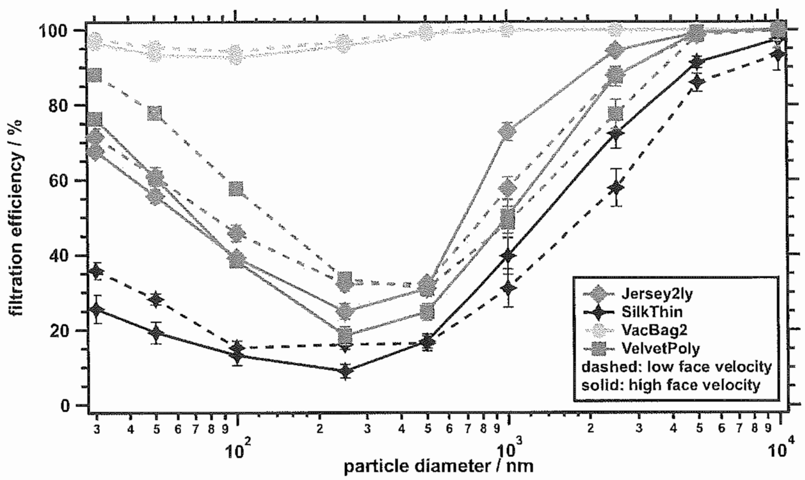
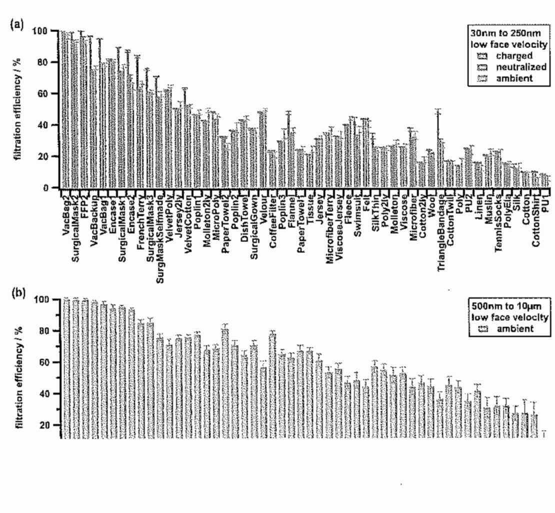


Figure 2. Filtration efficiency as a function of particle diameter measured using ambient aerosol (*SMPS/OPC setup*) at low (5.3 cm s^{-1}, dashed lines) and high (12.9 cm s^{-1}, solid lines) face velocity for cotton jersey (2 layers), thin silk, vacuum cleaner bag #2, and velvet polyester.

A very large spread in filtration efficiencies was observed for all particle sizes between the various materials and even between the different surgical masks (SI Figure S7). For many samples, high filtration efficiency for large particles was found: more than 30 of the samples have $FE > 80\%$ for particles with $d_p \geq 5$ µm. In contrast, only few samples showed good filtration efficiency for very small particles: only six samples at the lower and even fewer at the higher face velocity filtered >80% of 30 nm diameter particles. In the filtration minimum, only seven samples were able to filter >50% of the particles at the higher face velocity; all these materials were nonwoven materials like medical masks, mattress encasement, vacuum cleaner bags, and backup filter.

For direct comparison of all sample materials, *FE* bar charts for each particle size are presented in the SI (Figures S9–S22). As particle deposition for particles with sizes below or above the filtration minimum is dominated by different mechanisms, we calculated average filtration efficiencies for both particle size ranges (*small particles*: $d_p = 30$ nm–250 nm; *large particles*: $d_p = 500$ nm–10 µm) for simpler comparison of potential mask materials (Figure 3 and SI Figure S8 for low and high face velocity, respectively). The pressure drop across the sample material was determined for standard flow conditions (i.e., 8 L min^{-1} flow rate through a sample of 25 mm diameter) as defined for certification of surgical face masks in the European standard EN14683 (2019). According to this standard, these pressure drops are calculated by dividing the measured pressure drop by the sample area (4.9 cm^2) and are provided in units of Pa cm^{-2} (Figure 3c).



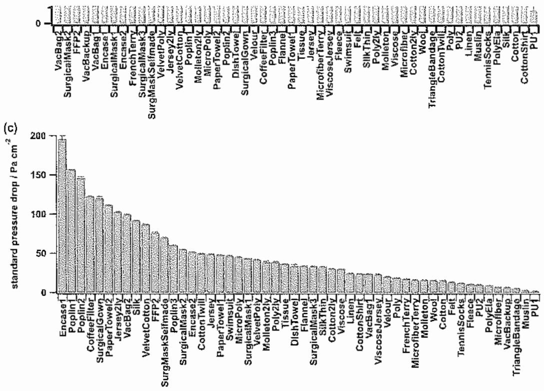


Figure 3. Filtration efficiencies measured at low face velocity (5.3 cm s^{-1}) for (a) small particles (d_p = 30 to 250 nm) in neutralized, charged (both *CPC setup*), and ambient (*SMPS/OPC setup*) aerosol, and for (b) large particles (d_p = 500 nm to 10 µm) in ambient aerosol (*SMPS/OPC setup*). Values are sorted according to filtration efficiency averaged over all particle sizes. (c) shows the standard pressure drop across the samples, sorted for decreasing values.

FE for small particles (Figure 3a and SI Figure S8) are presented for completely charged, neutralized, and ambient aerosol. For materials with charged fibers, electrostatic attraction can enhance *FE* for particles in this size range. Therefore, enhanced *FE* for the charged aerosol is a good indication that the respective sample material contains either permanently or temporarily (e.g., due to the handling of the material) electrostatic charges on its fibers. Almost all materials which show such behavior consist completely or largely of synthetic components. The only exceptions to this are velvet cotton and thin silk, which are made of pure cotton and silk, respectively, and show slightly higher filtration efficiency for charged aerosol, compared to incompletely charged aerosol.

The largest *FE* were mostly found for samples with a strong electrostatic deposition component. However, a strong electrostatic deposition component is not a guarantee for good filtration efficiency. Several samples like flannel, thin silk, swimsuit, or the triangle bandage show enhanced filtration efficiency for charged particles, albeit at rather low overall *FE* level (Figure 3a). Generally, filtration efficiency for ambient, i.e., incompletely charged, aerosol is relatively low for small particles with only four samples (vacuum cleaner bag #2, encasement #1, FFP2, and surgical mask #2) exceeding 80% *FE* on average. Extremely low filtration efficiencies (polyester, polyester with elastane, woven cotton, cotton shirt, silk, linen, polyurethane foam samples) are associated with either thin or rather open material structures, i.e., with materials with high porosity.

Filtration efficiencies for large particles (Figure 3b) are typically larger than those for small particles (Figure 3a). Especially for the largest particles used in this study (d_p = 5 µm and 10 µm) *FE* approaching 100% were found for many samples (SI Figures S21 and S22). Unsurprisingly, the largest filtration efficiencies were mostly found for materials which were specifically designed for the purpose of filtering particles, like vacuum cleaner bags or medical masks. However, also many other materials show substantial filtration capability ($FE \geq 50\%$) for the large particle size range. Therefore, these could be useful in masks if it is intended to remove larger respiratory droplets from the air flow.

The best filtration efficiency is not very helpful for making a cloth mask if it is too hard to breathe through the respective material. Even though all samples were selected as potential candidates for making cloth masks, e.g., from the point of view of material strength or sample material thickness, very significant differences were found in the measured pressure drop values (Figure 3c). Three self-made masks made of mattress encasement and of poplin combinations showed the largest pressure drop values of ca. 150 to 200 Pa cm^{-2}. Many of the other samples ranged between 20 and 50 Pa cm^{-2}, where also the surgical masks can be found. A few samples like muslin, a microfiber cloth, vacuum cleaner bag backup filter, triangle bandage, polyester with elastane, and PU foam were very easy to breathe through with pressure drop values below 10 Pa cm^{-2}.

4.2. Dependence of filtration efficiency and pressure drop on face velocity and number of layers

To determine the relationships between face velocity, number of layers of the material, pressure drop, and filtration efficiency, we performed a number of systematic measurements. For a selection of four materials (cotton jersey, cotton woven, molleton, and polyester) we measured *FE* and Δp for samples with different number of layers (one to five) with low and high face velocity and, for one and two layers, with different face velocities (2.8, 5.3, 9.1, 12.9, 25.4 cm s^{-1}). These materials were selected because they showed sufficiently low *FE* and Δp for a single layer that also allows reasonable measurements at samples of five layers. In addition, they covered both, woven and non-woven materials, and several of them are of general relevance for self-made face masks.

As expected, with increasing face velocity, we observed an increase in pressure drop across the sample (Figure 4a). This reflects that it is harder to breathe through the material of the face mask when the respiratory flow is larger. As the measured pressure drop values for single layered samples were consistently half the values of the double layered samples, we only present results for the latter ones, which

have smaller relative uncertainty due to higher Δp levels. A power law function

$$\Delta p(v_f) = \Delta p(0) + A_{\Delta p} \cdot v_f{}^s \tag{1}$$

was fitted, with $\Delta p(v_f)$ the pressure drop in Pascal at face velocity v_f (in cm s^{-1}), $A_{\Delta p}$ (in Pa) the magnitude of the pressure drop increase with increasing v_f, and s the exponent describing the shape of the increase (see SI Table S2 for the individual fitting coefficients). For cotton jersey, the pressure drop curve flattens ($s = 0.80$) probably due to widening of the stitch openings at higher flow rates. For the other materials, s is above unity.

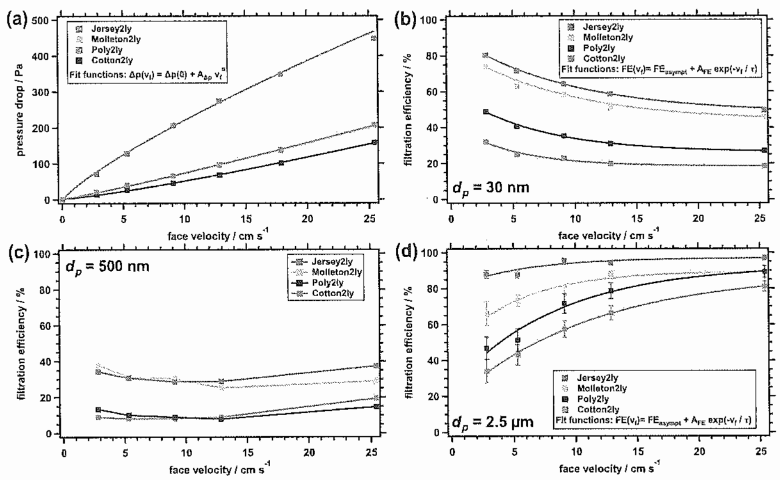


Figure 4. Dependence of (a) pressure drop and (b–d) filtration efficiencies at different particle sizes (30 nm, 500 nm, both neutralized aerosol, *CPC setup*; 2.5 µm, ambient aerosol, *SMPS/OPC setup*) on face velocity for polyester, cotton woven, cotton jersey, and molleton (2 layers each). For the fitting coefficients, see Tables S2–S4 (supplementary information).

For small particles ($d_p \leq 250$ nm), *FE* decreases with increasing face velocity (Figure 4b for $d_p = 30$ nm), reflecting reduced particle deposition by diffusion and electrostatic attraction, due to reduced residence times within the filter material. Conversely, for large particles ($d_p \geq 2.5$ µm) *FE* increases with increasing face velocity (Figure 4d for $d_p = 2.5$ µm), due to enhanced impaction deposition at larger particle velocities. For both particle size ranges, *FE* dependence on face velocity v_f follows an exponential function reasonably well:

$$FE\left(v_f\right) = FE_{asympt} + A_{FE} \cdot \exp\left(-\frac{v_f}{\tau}\right) \tag{2}$$

with FE_{asympt} the asymptotic filtration efficiency (in %) for very large v_f (given in cm s^{-1}), A_{FE} (in %) the magnitude and τ (in cm s^{-1}) the v_f sensitivity of the filtration efficiency dependence. For the smaller particles ($d_p \leq 250$ nm, SI Table S3), A_{FE} is positive and *FE* decreases with increasing v_f, approaching the asymptotic filtration efficiency. Generally, in this particle size range, FE_{asympt} decreases with increasing particle size (range: 20%–50% for d_p=30 nm opposed to 7%–22% for $d_p = 250$ nm). For the larger particles ($d_p \geq 2.5$ µm, SI Table S4), A_{FE} is negative and *FE* increases with increasing face velocity. For almost all samples, FE_{asympt} approaches 100%, especially for the larger particles (i.e., $d_p = 5$ µm and 10 µm). This suggests improved filtration efficiencies for such particles under conditions where large face velocities occur, such as during coughing, sneezing, or heavy breathing, for the fraction of the air flow that passes through the mask material.

For an intermediate particle size range (Figure 4c for $d_p = 500$ nm), a transition occurs from decreasing *FE* with increasing face velocity in the lower v_f range to an increase in *FE* with face velocity in the upper v_f range. With increasing particle diameter, we observe a decrease in the face velocity where this transition occurs, in agreement with classical filtration theory (Hinds 1999).

Pressure drop dependences on the number of layers of sample material show a tight linear relationship (Figure 5a for $v_f = 5.3$ cm s^{-1}; see SI Table S5 for fitting coefficients). For zero layers one would expect $\Delta p = 0$ Pa. This was observed for cotton woven and molleton. For polyester and cotton jersey, however, a significant, albeit small, residual Δp was calculated equivalent of ¼ to $^1/_7$ layer of the material. Generally, however, in good approximation the observed pressure drop across the complete sample is proportional to the number of layers of the material.

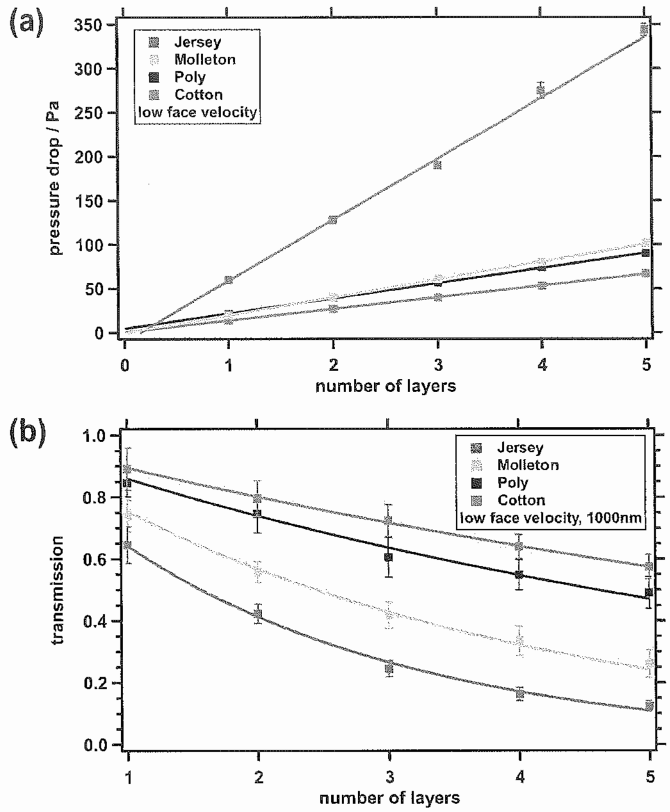


Figure 5. Dependence of (a) pressure drop and (b) transmission efficiency for 1 µm particles on number of layers of the respective material (polyester, cotton woven, cotton jersey, and molleton), measured at low face velocity in ambient aerosol (*SMPS/OPC setup*). Fit coefficients can be found in Tables S5a and S6b (supplementary information).

Filtration efficiency increases with the number of sample material layers. To test whether this dependence is in agreement with classical filtration theory (Hinds 1999), we used particle transmission ($T = 1 - FE[\%]/100$). Particle transmission T dependence on number of layers n for all four material samples (see Figure 5b for $d_p = 1$ µm and $v_f = 5.3$ cm s^{-1}) can reasonably well be fitted according to the following simple relationship:

$$T(n) = T(1)^n \tag{3}$$

with $T(1)$ the transmission for a single layer of material. A comparison of measured and fitted values for the single-layered material is provided in Table S6 (SI) for all four materials, all measured particle sizes as well as the lower and the higher face velocity.

We conclude that in good approximation the individual layers can be treated as separate filters which are connected in series and which do not interfere with each other strongly, e.g., due to alignment of layers. Therefore, the total pressure drop across the whole sample can be calculated by adding the pressure drops of the individual layers (Equation (4)), and the total transmission efficiency can be calculated by multiplying the transmission efficiencies of the individual layers (Equation (5)). This enables to calculate total pressure drop Δp_{total} and total filtration efficiency FE_{total} for cloth masks made of an arbitrary combination of layers L_i of textiles from the features of the individual components:

$$\Delta p_{total} = \Delta p_{L1} + \Delta p_{L2} + \ldots \tag{4}$$

$$FE_{total} = 1 - (T_{L1} \cdot T_{L2} \cdot \ldots) \tag{5}$$

This approach supersedes performing laborious measurements of filtration efficiency for combinations of materials in order to determine their suitability as basis for self-made face masks.

4.3. Which materials make a good filter – filter quality factor

As discussed above (Section 4.1), the selected sample materials showed not only a large variety of measured filtration efficiencies, but also of pressure drops. While some of the samples were already hard to breathe through, others showed such small pressure drops that for a face mask several layers of this material could well be used to increase the overall filtration efficiency. The dependency of pressure drop and filtration efficiency on number of material layers (Section 4.2) allows a more comprehensive comparison of the capabilities of potential filter materials using the filter quality factor q_f (Hinds 1999; Huang et al. 2013):

$$q_f = \frac{ln\left(\frac{1}{T}\right)}{\Delta p}, \tag{6}$$

where T is the fractional transmission and Δp (in Pa) the pressure drop. Filter quality factors for the lower face velocity ($v_f = 5.3\ \mathrm{cm\ s^{-1}}$) are summarized for small ($d_p = 30$ nm–250 nm) and large ($d_p = 500$ nm–10 μm) particles separately in Figure 6a; those for the larger face velocity ($v_f = 12.9\ \mathrm{cm\ s^{-1}}$) are shown in the SI in Figure S23a.

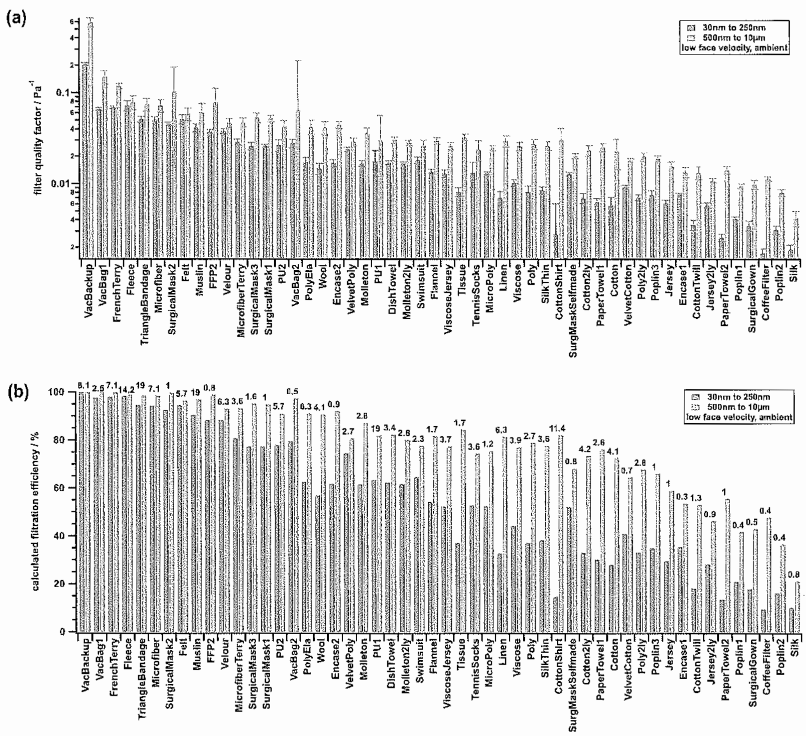


Figure 6. a) Filter quality factor q_f determined for small (d_p=30 nm to 250 nm) and large (d_p=500 nm to 10 μm) particles in ambient aerosol (*SMPS/OPC setup*) at low face velocity. Values are sorted according to q_f averaged over all particle sizes. (b) Calculated filtration efficiency for small and large particles (ambient aerosol, *SMPS/OPC setup*, low face velocity, sorted as in (a)) for "reference pressure drop" cloth stacks. Above the bars the number of layers of this material is given which is needed to reach the reference pressure drop.

Combining *FE* and *Δp* does not make the samples more similar: variability of filter quality factors is not smaller than that of *FE*. However, the order in which the various samples appear within the quality factor chart (reflecting the relative quality compared to other samples) has changed considerably compared to that of *FE* (Figure 3). Especially several materials with very low pressure drop have moved towards the left end ("better" filtration characteristics) of the chart and replaced others with high *FE*, but also high Δp. As a consequence, in this chart also a number of regular household materials and fluffy textiles like French terry, fleece, microfiber cloth, felt, muslin, or velour moved to the front end of the ranking, while several rather firm materials like poplin, surgical gown, or silk, but also one of the paper towel samples and the coffee filter moved towards the right end of the chart (i.e., "worse" filtration characteristics).

Filter quality factor is a rather abstract quantity. To present a more practical number which allows direct comparison of potential cloth mask materials, we use Equations (4) and (5) to calculate the hypothetical *FE* for each sample material for a cloth stack which would have the same pressure drop as surgical mask #1 as (arbitrarily selected) reference. In Figure 6b, we present these calculated filtration efficiencies for the smaller face velocity together with the hypothetical number of layers applied (SI Figure S23b for the larger v_f).

Filtration efficiencies for these hypothetical "reference pressure drop" masks reach high values for many sample materials, especially for the large particle size range, where about two thirds of all masks would have filtration efficiencies >80%. Depending on *Δp* at the individual layer, this would involve masks with often 4–7 layers and in some cases around 20 layers of material. Especially for materials

with extremely low pressure drop at the single layer and very large thickness of the layer, this would result in very thick masks; e.g., the PU foam "reference pressure drop" mask would have 19 layers with a total thickness of more than 10 cm, which is quite impractical. Nevertheless, this comparison shows that using multiple layers of fabric would enable to produce cloth masks from many materials with reasonable filtration efficiency.

4.4. Influence of material density on filtration efficiency

For individual pairs of materials we find larger filtration efficiency for the material with larger thread count than for the material with the smaller one, similar to the findings of Konda et al. (2020); however, this is not a general feature. When correlating *FE* with thread count (SI Figure S25), we do not find a general relationship between these two variables, even when limiting the correlation to only a sub-group of materials (e.g., only cotton materials). This is probably because larger thread count is typically also related to thinner threads, which in turn reduces material thickness with negative impact on *FE*. Also when correlating filter quality factor with thread count (SI Figure S27), we do not find a strong dependency between these two variables, if at all a slight decrease in q_f with increasing thread count.

Filtration efficiency plotted versus material area density is presented in Figures S24a and b (SI) for small and large particles, respectively. For small particles, no general trend was found for all samples. However, restricting the correlation to regular textiles, we find a general trend of increasing *FE* with increasing material area density. This increase is probably associated with increasing material thickness along these lines, associated with longer particle residence time within the filter material. For the large particles or for q_f (SI Figure S26), however, we do not find such a relationship.

4.5. Deposition by electrostatic attraction

Dedicated filtration materials as those used in respirators, surgical masks, or vacuum cleaner bags typically consist of non-woven fibers (Shimasaki et al. 2018) which carry permanent electrostatic charges to improve deposition of very small particles (Huang et al. 2013). To investigate the contribution of electrostatic attraction to overall particle removal, which likely caused enhanced *FE* for small, charged particles (Figure 3a and Section 4.1), we use the measured filtration efficiency for the charged aerosol $FE_{meas,charged}$ and of the neutralized aerosol $FE_{meas,neutr}$. With the fraction of charged particles $X_{ch}(d_p)$ in charge equilibrium for the respective particle size d_p (Wiedensohler 1988) we calculate the filtration efficiency due to diffusion FE_{diff} and that due to electrostatic attraction (FE_{ES}) according to:

$$FE_{diff} = \frac{FE_{meas,neutr} - X_{ch}(d_p) \cdot FE_{meas,charged}}{1 - X_{ch}(d_p)} \tag{7}$$

$$FE_{ES} = \frac{FE_{meas,charged} - FE_{diff}}{1 - FE_{diff}} \tag{8}$$

As a measure of the contribution of electrostatic attraction to overall *FE*, we calculate the ratio of FE_{ES} to FE_{diff} for each sample material, averaged for d_p = 30 nm–100 nm, where we expect and observe enhanced *FE* for the charged aerosol. In Figure 7, the electrostatic attraction-to-diffusion contribution ratio is presented for all samples, obtained at the lower face velocity (v_f = 5.3 cm s^{-1}; measurements at the higher face velocity show a similar trend, however, are affected by stronger noise), sorted along decreasing FE_{ES}/FE_{diff} ratios.

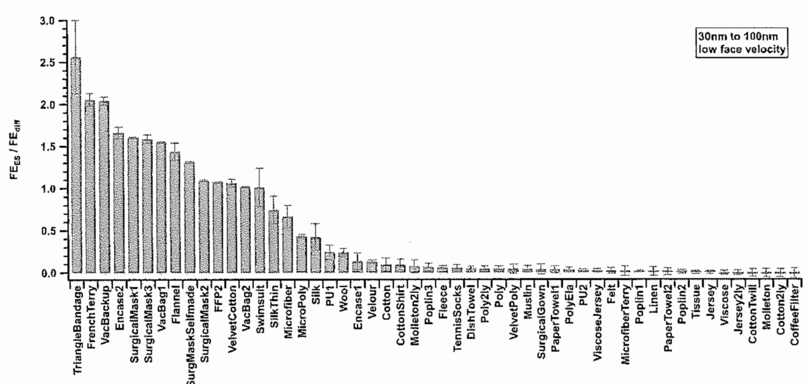


Figure 7. Ratio of filtration efficiencies due to electrostatic attraction (FE_{ES}) to filtration efficiencies due to diffusion (FE_{diff}) obtained at low face velocity for $d_p \leq 100$ nm with the *CPC setup*, sorted for decreasing ratios.

For fourteen of the samples, mainly materials designed for filtration of particles like medical masks or vacuum cleaner bags, but also for triangle bandage, swimsuit material, French terry, flannel or velvet cotton, the contribution of electrostatic attraction to overall deposition is at least as large as the contribution by diffusion. Several other materials, mostly synthetic ones, also show significant electrostatic deposition, although at a lower level. Velvet cotton, silk, and wool are some of the few non-synthetic materials for which we could identify substantial electrostatic contribution to overall deposition. Likely, electrostatic charge in these samples is not permanent but generated during handling of the material. For most samples consisting of natural fibers, we found only very small or negligible contributions to small-particle deposition by electrostatic attraction.

4.6. How strongly do leaks affect filtration efficiency?

Surgical masks as well as cloth masks never have a perfect fit on the face. Leaks between the mask material and the skin allow air to pass through without being filtered by the mask material. This is one of the main reasons why in studies investigating filter efficiencies of masks under real life conditions for surgical masks significantly lower filtration rates have been found compared to, e.g., N95 (similar to FFP2 or KN95) respirators (Grinshpun et al. 2009; Chu et al. 2020).

To obtain an estimate on the influence of leaks on overall filtration efficiency of the mask material we performed dedicated measurements with two sample materials with defined leaks. These materials, a surgical mask (surgical mask #4, not investigated in the previous sections) and the velvet cotton sample, were selected due to their relatively high filtration efficiency and good mechanical stability (to avoid unraveling of the leaks during the measurements) but with different pressure drops. Four samples were probed at $v_f =$ 5.3 cm s^{-1}: a completely intact sample, and samples with 0.5%, 1%, and 2% of the sample area being punched out, in each case distributed over three holes across the sample. In addition, we measured *FE* of the "leaking" samples using a flow rate that generated the same pressure drop at the sample as the one observed for the measurement at v_f= 5.3 cm s^{-1} for the leak-free sample. Under these conditions, we assume that the face velocity through the filter material is the same in both cases and that the additional flow through the leaking sample passes through the holes.

Filtration efficiencies, normalized to those measured at the leak-free sample, plotted versus the relative leak area (Figure 8) directly provide the relative reduction of the filtration efficiency due to the leaks. For particles with $d_p \leq 2.5$ µm (solid lines in Figure 8) *FE* decreases by 50% for a leak of 1% of the sample area and by about two thirds for a 2%-leak. The decrease is slightly higher for the velvet cotton sample (red traces), compared to the surgical mask sample (blue traces). This is because Δp at the velvet cotton sample is larger than at the surgical mask and consequently a larger fraction of the total flow passes through the holes instead of the sample material. For 10 µm particles (dashed lines in Figure 8) the observed decrease in filtration efficiency is smaller compared to that for smaller particles. This suggests that the larger particles do not follow the flow streamlines into the holes as well as the smaller particles do, and more of them have to pass through the filter material. Estimates of the "separation efficiency" of the leaks (see Section S3 and Figure S28 in the SI) suggest that this is the case for particles with $d_p \geq 5$ µm, with increasing efficiency as particle size increases.

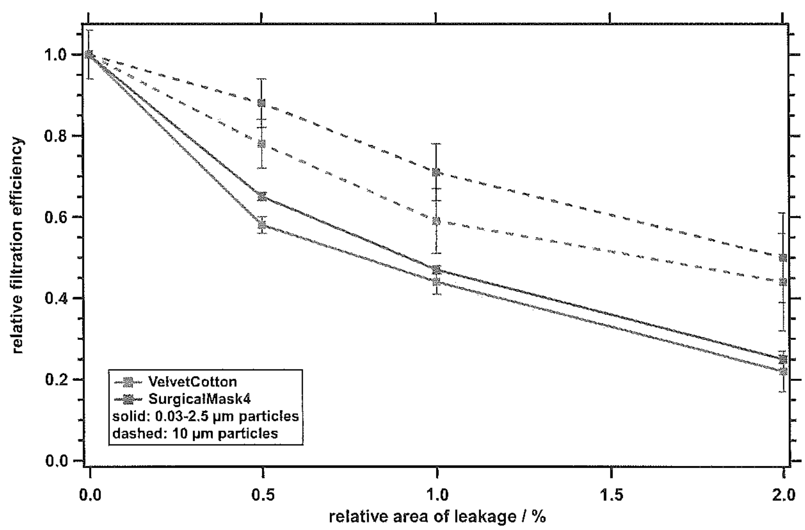


Figure 8. Filtration efficiency for velvet cotton (red) and surgical mask (blue) samples for $d_p \leq 2.5$ µm (solid line) and d_p = 10 µm (dashed line) versus relative leak area, normalized to the leak-free sample. Here, measurements of neutralized (*CPC setup*) and ambient aerosol (*SMPS/OPC setup*) were averaged, where available.

These measurements cannot be much more than a qualitative description of the effects of leaks on the overall filtration efficiency of face masks. The fractional flow through a leak and the leak separation efficiency depend not only on the relative leak area and pressure drop of the mask material, but also on other variables like shape and position of the leaks. Nevertheless, these measurements showed that already very small leaks in the order of one percent of the total sample area can substantially reduce the overall filtration efficiency of a mask down to half or even less compared with the value of the material itself. Therefore, it is critical that the leak area is kept at a minimum. However, impaction of large particles on the mask surface will reduce the leak-related transmission of the largest droplets, e.g., from speaking, coughing, or sneezing, at least to a certain degree. The relatively large droplet velocities of several meters per second (Chao et al. 2009) occurring in such processes will further support impaction losses within the leaking mask. To obtain more quantitative results on the influence of leaks, more dedicated and detailed experiments need to be performed.

5. Discussion

Several studies found in the literature focusing on efficacy or filtration performance of cloth face masks come to very different conclusions. Several authors observe that some of the cloth masks filter fine or ultrafine particles with similar or even better efficiency, compared to KN95 or N95 (both similar to FFP2) masks (Lustig et al. 2020; Konda et al. 2020). Contrary, others find that cloth masks provide only very low or at least significantly lower filtration efficiency compared to N95 or surgical masks (Shakya et al. 2017; Rengasamy, Eimer, and Shaffer 2010; Bae et al. 2020; Davies et al. 2013).

Cloth mask filtration efficiencies larger than those found for N95 masks are not in agreement with our results, at least not for numbers of fabric layers as typically used in masks. We suspect that large filtration efficiencies for "virus-like nanoparticles" which were reported by Lustig et al. (2020) are mainly caused by the fact that these nanoparticles were applied to the filtration media suspended in droplets with typical sizes of 10–20 µm. Therefore, filtration efficiency was not measured for nanoparticles but for relatively large droplets. Also results by Konda et al. (2020), who found better filtration efficiencies for combinations of cotton with silk, chiffon, and flannel than for a N95 mask over a large particle size range are hard to understand. According to filtration theory and to our measurements filtration efficiency for very small particles should increase as particle size decreases, whereas Konda et al. (2020) reported the opposite behavior for $d_p < 80$ nm for the N95 mask. Their results for several other cloth materials, however, are in good agreement with our findings, including the observation that multiple layers of cloth material result in significantly enhanced filtration efficiencies.

Rengasamy, Eimer, and Shaffer (2010) found filtration efficiencies for various cloth masks and materials in the order of 10%–60% for polydisperse aerosols (d_p = 20 nm–1000 nm), which agrees well with our findings. Shakya et al. (2017) observed filtration efficiencies between 40% and 80% with a filtration minimum around d_p = 500 nm for several cloth masks using monodisperse particles (d_p = 30 nm–2.5 µm), similar to our results. These authors, as well as Davies et al. (2013), found significantly larger filtration efficiency for surgical masks, compared to homemade masks, also in good agreement with our findings.

We found considerable differences in filtration efficiency for particles of different sizes but also between the individual samples. In addition, we observed large differences in pressure drop across the sample. For many materials, this allows stacking of several layers without reaching excessive pressure drop levels, with significantly improved filtration capability of the resulting cloth stack. Calculated filtration efficiencies for textile stacks with the same pressure drop as observed for a surgical mask reached very high values for large particles, i.e., $d_p \geq 500$ nm, and still decent levels for the smaller particles for many sample materials, mainly for those which were designed to filter particles and for fluffy textiles like, e.g., French terry, fleece, felt, or velour.

Measurements with defined leaks in the samples revealed that leaks of only a few percent of the mask area will substantially degrade the overall mask filtration efficiency. Leaks next to the nose can be minimized using nose clips. However, leaks at the remaining circumference of the mask strongly depend on the shape of the mask. Cup-shaped or fold-up masks have the potential to fit better onto the face with less leak area than pleated masks like surgical masks, however for this purpose they need to have the right size.

The measurements of this study provide information on filtration efficiency and pressure drop at various face masks and potential mask materials under the conditions of the measurements. We did not apply a breathing cycle with up- and down-swelling flow rate. This would likely influence the absolute values of filtration efficiencies; however, we do not expect that this will strongly affect the intercomparison between different sample materials. We also did not humidify the air flow. Large relative humidity of the flow through the mask materials will likely cause a wetting of the material. This could alter the transmission of particles through the material, e.g., as a consequence of swelling of fibers when they get wet. We also did not investigate the effects of cleaning (e.g., washing) the sample materials on both, filtration efficiency and pressure drop. Neupane et al. (2019) have shown that filtration efficiency of cloth masks dropped by 20% after the fourth washing and drying cycle as a consequence of changed pore size and shape. Since homemade masks typically are washed and re-used many times, this effect as well as the influence of humidity should be more thoroughly studied in future experiments. Extreme flow situations, like coughing or sneezing which produce jets of particles moving at high velocities (Chao et al. 2009; Han, Weng, and Huang 2013; Liu and Novoselac 2014), have also not been studied here. We hypothesize that under such conditions, leaks of the masks will open further, reducing the overall filtration efficiency – at least for the smaller particles which do not

impact on the inner surface of the mask.

6. Summary

Filtration efficiencies (FE) of face masks and potential mask materials were determined for particles ranging from $d_p = 30$ nm–10 μm. For this purpose, size-resolved particle number concentrations upstream and downstream the sample material were determined in two different setups while it was passed by the aerosol-laden air. In addition, the pressure drop (Δp) across the samples was measured and the dependency of FE on face velocity, particle charge and number of sample layers was investigated.

A total of 48 different sample materials were tested. This included three regular surgical masks and an FFP2 respirator for comparison, several pure cotton and cotton mixed with synthetics textiles, synthetic cloths, but also a large variety of other materials which can be found in a regular household like PU foams, triangle bandage, paper towels, or a coffee filter.

Generally, a large variety of filtration efficiencies was found and a filtration minimum was observed for particles between 50 nm and 500 nm diameter with typically larger filtration efficiency found for large particles (d_p > 2.5 μm), compared to small ones (d_p < 100 nm). With increasing face velocity, we found a decrease in FE for small particles ($d_p \leq 250$ nm) and an increase in FE for large particles ($d_p \geq 2.5$ μm) due to the different loss mechanisms involved.

Filtration efficiency and pressure drop measured for different numbers of material layers showed that each layer can be treated as individual filter. Total FE of the whole stack can readily be estimated by multiplying the individual transmission efficiencies (T = 1-FE), while total pressure drop (Δp) is the sum of the individual pressure drops. This allows the use of the filter quality factor, which considers both, FE and Δp for comparison of stacked cloth materials. Calculations for hypothetical cloth stacks with similar pressure drop as observed for a surgical mask revealed that by stacking adequate numbers of layers of the various sample materials it is possible to obtain decent filtration efficiency using cloth materials.

From measurements of completely charged aerosols and aerosols in charge equilibrium we estimated the contribution of electrostatic attraction to overall deposition for the individual sample materials for small particles ($d_p \leq 100$ nm). Fourteen of the sample materials, mainly synthetic materials but also one cotton and two cotton mixed with synthetic samples, showed an electrostatic deposition contribution which was at least as large as deposition by diffusion.

Measurements using samples with defined leaks covering 0.5%–2% of the sample area showed substantial reduction in total filtration efficiency by 50% to two thirds of the value obtained with the leak-free sample. Particles of $d_p \geq 5$ μm tend not to follow the leak flow completely and are deposited on the samples to a certain degree.

Our measurements show that face masks made of cloth materials can reach decent filtration efficiency over a large particle size range, when stacked to an adequate number of layers, especially if materials designed to filter aerosol particles or fluffy textiles like, e.g., French terry, fleece, felt, or velour are used. Total filtration efficiency and pressure drop can be estimated readily from the respective values for the individual layers, leaving labor-intensive measurements of textile combinations unnecessary. Besides these features, selection of cloths for homemade face masks must always consider that no harmful substances are released by the material, which was not part of this study. This might exclude some chemically treated household materials for this usage, like vacuum cleaner bags with antibacterial treatment. However, even the best filtration efficiency is easily degraded if the mask does not have a good fit and a significant fraction of the respiratory air is permitted to pass through leaks between mask and face.

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References

Asadi, S., A. S. Wexler, C. D. Cappa, S. Barreda, N. M. Bouvier, and W. D. Ristenpart. 2019. Aerosol emission and superemission during human speech increase with voice loudness. *Sci. Rep.* 9 (1):2348. Crossref. PubMed.

Bae, S., M. C. Kim, J. Y. Kim, H. H. Cha, J. S. Lim, J. Jung, M. J. Kim, D. K. Oh, M. K. Lee, S. H. Choi, et al. 2020. Effectiveness of surgical and cotton masks in blocking SARS-CoV-2: A controlled comparison in 4 patients. *Ann. Intern. Med.* 173 (1):W22–W23. Crossref. PubMed.

Bake, B., P. Larsson, G. Ljungkvist, E. Ljungström, and A.-C. Olin. 2019. Exhaled particles and small airways. *Respir. Res.* 20 (1):8. Crossref. PubMed.

Chao, C. Y. H., M. P. Wan, L. Morawska, G. R. Johnson, Z. D. Ristovski, M. Hargreaves, K. Mengersen, S. Corbett, Y. Li, X. Xie, et al. 2009. Characterization of expiration air jets and droplet size distributions immediately at the mouth opening. *J. Aerosol Sci.* 40 (2):122–33. Crossref. PubMed.

Chaudhuri, S., S. Basu, P. Kabi, V. R. Unni, and A. Saha. 2020. Modeling the role of respiratory droplets in Covid-19 type pandemics. *Phys. Fluids.* 32 (6):063309. Crossref. PubMed.

Chu, D. K., E. A. Akl, S. Duda, K. Solo, S. Yaacoub, H. J. Schünemann, D. K. Chu, E. A. Akl, A. El-Harakeh, A. Bognanni, et al. 2020. Physical

distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: a systematic review and meta-analysis. *Lancet* 395 (10242):1973–87. Crossref. PubMed.

Davies, A., K.-A. Thompson, K. Giri, G. Kafatos, J. Walker, and A. Bennett. 2013. Testing the efficacy of homemade masks: Would they protect in an influenza pandemic?. *Disaster Med. Public Health Prep.* 7 (4):413–8. Crossref. PubMed.

EN14683. 2019. *Medical face masks – Requirements and test methods*. German version EN 14683:2019 + AC:2019. DIN Deutsches Institut für Normung e.V. Berlin: Beuth Verlag GmbH.

Gralton, J., E. Tovey, M.-L. McLaws, and W. D. Rawlinson. 2011. The role of particle size in aerosolised pathogen transmission: A review. *J. Infect.* 62 (1):1–13. Crossref. PubMed.

Grinshpun, S. A., H. Haruta, R. M. Eninger, T. Reponen, R. T. McKay, and S.-A. Lee. 2009. Performance of an N95 filtering facepiece particulate respirator and a surgical mask during human breathing: Two pathways for particle penetration. *J Occup. Environ. Hyg.* 6 (10):593–603. Crossref. PubMed.

Hadei, M., P. K. Hopke, A. Jonidi, and A. Shahsavani. 2020. A letter about the airborne transmission of SARS-CoV-2 based on the current evidence. *Aerosol Air Qual. Res.* 20 (5):911–4. Crossref.

Han, Z. Y., W. G. Weng, and Q. Y. Huang. 2013. Characterizations of particle size distribution of the droplets exhaled by sneeze. *J. R. Soc. Interface* 10 (88):20130560. Crossref. PubMed.

Hinds, W. C. 1999. *Aerosol technology – Properties, behavior, and measurement of airborne particles*. 2nd ed. New York: Wiley Interscience, John Wiley & Sons.

Huang, S. H., C. W. Chen, Y. M. Kuo, C. Y. Lai, R. McKay, and C. C. Chen. 2013. Factors affecting penetration and quality factor of particulate respirators. *Aerosol Air Qual. Res.* 13 (1):162–71. Crossref.

Jacobson, M. Z. 2012. *Air pollution and global warming: History, science, and solutions*. New York: Cambridge University Press. Crossref.

Johnson, G. R., L. Morawska, Z. D. Ristovski, M. Hargreaves, K. Mengersen, C. Y. H. Chao, M. P. Wan, Y. Li, X. Xie, D. Katoshevski, et al. 2011. Modality of human expired aerosol size distributions. *J. Aerosol Sci.* 42 (12):839–51. Crossref.

Klompas, M., M. A. Baker, and C. Rhee. 2020. Airborne transmission of SARS-CoV-2: Theoretical considerations and available evidence. *J. Am. Med. Assoc.* 324 (5):441–442. Crossref.

Konda, A., A. Prakash, G. A. Moss, M. Schmoldt, G. D. Grant, and S. Guha. 2020. Aerosol filtration efficiency of common fabrics used in respiratory cloth masks. *ACS Nano* 14 (5):6339–47. Crossref. PubMed.

Kutter, J. S., M. I. Spronken, P. L. Fraaij, R. A. M. Fouchier, and S. Herfst. 2018. Transmission routes of respiratory viruses among humans. *Curr. Opin. Virol.* 28:142–51. Crossref. PubMed.

Lee, S.-A., S. A. Grinshpun, and T. Reponen. 2008. Respiratory performance offered by N95 respirators and surgical masks: Human subject evaluation with NaCl aerosol representing bacterial and viral particle size range. *Ann. Occup. Hyg.* 52 (3):177–85. Crossref. PubMed.

Leopoldina – German National Academy of Sciences. 2020. *Coronavirus pandemic – Measures relevant to health*. 2nd Ad-hoc-Statement. Halle, Germany: German National Academy of Sciences Leopoldina. Accessed July 27, 2020 https://www.leopoldina.org/en/publications/detailview/publication/coronavirus-pandemie-gesundheitsrelevante-massnahmen-3-april-2020/.

Li, Y., H. Qian, J. Hang, X. Chen, L. Hong, P. Liang, J. Li, S. Xiao, J. Wei, L. Liu, et al. 2020. Evidence for probable aerosol transmission of SARS-CoV-2 in a poorly ventilated restaurant. *MedRxiv*.. Forthcoming. Crossref.

Liu, S., and A. Novoselac. 2014. Transport of airborne particles from an unobstructed cough jet. *Aerosol Sci. Technol.* 48 (11):1183–94. Crossref.

Lustig, S. R., J. J. H. Biswakarma, D. Rana, S. H. Tilford, W. Hu, M. Su, and M. S. Rosenblatt. 2020. Effectiveness of common fabrics to block aqueous aerosols of virus-like nanoparticles. *ACS Nano* 14 (6):7651–8. Crossref. PubMed.

Morawska, L., G. R. Johnson, Z. D. Ristovski, M. Hargreaves, K. Mengersen, S. Corbett, C. Y. H. Chao, Y. Li, and D. Katoshevski. 2009. Size distribution and sites of origin of droplets expelled from the human respiratory tract during expiratory activities. *J. Aerosol Sci.* 40 (3):256–69. Crossref.

Morawska, L., and D. K. Milton. 2020. It is time to address airborne transmission of COVID-19. *Clin. Infect. Dis.* doi:. Forthcoming. Crossref. PubMed.

Neupane, B. B., S. Mainali, A. Sharma, and B. Giri. 2019. Optical microscopic study of surface morphology and filtering efficiency of face masks. *PeerJ* 7:e7142. Crossref. PubMed.

Oberdörster, G., E. Oberdörster, and J. Oberdörster. 2005. Nanotoxicology: An emerging discipline evolving from studies of ultrafine particles. *Environ. Health Perspect.* 113 (7):823–39. Crossref. PubMed.

Oberg, T., and L. M. Brosseau. 2008. Surgical mask filter and fit performance. *Am. J. Infect. Control* 36 (4):276–82. Crossref. PubMed.

Parienta, D., L. Morawska, G. R. Johnson, Z. D. Ristovski, M. Hargreaves, K. Mengersen, S. Corbett, C. Y. H. Chao, Y. Li, and D. Katoshevski. 2011. Theoretical analysis of the motion and evaporation of exhaled respiratory droplets of mixed composition. *J. Aerosol Sci.* 42 (1):1–10. Crossref.

Rengasamy, S., B. Eimer, and R. E. Shaffer. 2010. Simple respiratory protection – Evaluation of the filtration performance of cloth masks and common fabric materials against 20-1000 nm size particles. *Ann. Occup. Hyg.* 54 (7):789–98. Crossref. PubMed.

Shakya, K. M., A. Noyes, R. Kallin, and R. E. Peltier. 2017. Evaluating the efficacy of cloth facemasks in reducing particulate matter exposure. *J. Expo. Sci. Environ. Epidemiol.* 27 (3):352–7. Crossref. PubMed.

Shimasaki, N., A. Okaue, R. Kikuno, and K. Shinohara. 2018. Comparison of the filter efficiency of medical nonwoven fabrics against three different microbe aerosols. *Biocontrol Sci.* 23 (2):61–9. Crossref. PubMed.

van Doremalen, N., T. Bushmaker, D. H. Morris, M. G. Holbrook, A. Gamble, B. N. Williamson, A. Tamin, J. L. Harcourt, N. J. Thornburg, S. I. Gerber, et al. 2020. Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1. *N. Engl. J. Med* 382 (16):1564–7. Crossref. PubMed.

WHO (World Health Organization). 2014. *Infection prevention and control of epidemic- and pandemic-prone acute respiratory infections in health care*. Geneva, Switzerland: World Health Organization. Accessed July 03, 2020. https://www.who.int/csr/bioriskreduction/infection_control/publication/en/.

WHO (World Health Organization). 2016. *Ambient air pollution: a global assessment of exposure and burden of disease*. Geneva, Switzerland: World Health Organization. Accessed July 03, 2020. https://www.who.int/phe/publications/air-pollution-global-assessment/en/.

WHO (World Health Organization). 2020a. *Country & technical guidance – Coronavirus disease (COVID-19)*. Geneva, Switzerland: World Health Organization. Accessed July 03, 2020. https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance-publications.

WHO (World Health Organization). 2020b. *Advice on the use of masks in the context of COVID-19. Interim guidance*. Geneva, Switzerland: World Health Organization. Accessed July 03, 2020. https://www.who.int/publications/i/item/advice-on-the-use-of-masks-in-the-community-during-home-care-and-in-healthcare-settings-in-the-context-of-the-novel-coronavirus-(2019-ncov)-outbreak.

WHO (World Health Organization). 2020c. *Coronavirus disease 2019 (COVID-19): Situation Report – 66, March 26, 2020*. Geneva, Switzerland: World Health Organization. Accessed July 10, 2020. https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200326-sitrep-66-covid-19.pdf.

Wiedensohler, A. 1988. An approximation of the bipolar charge distribution for particles in the submicron size range. *J. Aerosol Sci.* 19 (3):387–9. Crossref.

Zhang, R., Y. Li, A. L. Zhang, Y. Wang, and M. J. Molina. 2020. Identifying airborne transmission as the dominant route for the spread of COVID-19. *Proc. Natl. Acad. Sci. USA.* 117 (26):14857–63. Crossref. PubMed.

EXHIBIT viii

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Review

Is a Mask That Covers the Mouth and Nose Free from Undesirable Side Effects in Everyday Use and Free of Potential Hazards?

Kai Kisielinski [1], Paul Giboni [2], Andreas Prescher [3], Bernd Klosterhalfen [4], David Graessel [5], Stefan Funken [6], Oliver Kempski [7] and Oliver Hirsch [8,*]

1 Private Practice, 40212 Düsseldorf, Germany; kaikisielinski@yahoo.de
2 Private Practice, 22763 Hamburg, Germany; pgiboni@gmx.de
3 Institute of Molecular and Cellular Anatomy (MOCA), Wendlingweg 2, 52074 Aachen, Germany; aprescher@ukaachen.de
4 Institute of Pathology, Dueren Hospital, Roonstrasse 30, 52351 Dueren, Germany; bernd.klosterhalfen@web.de
5 Institute of Neuroscience and Medicine, Forschungszentrum Jülich, 52425 Jülich, Germany; d.graessel@fz-juelich.de
6 Private Practice, 47803 Krefeld, Germany; dr_funken@colita.net
7 Institute of Neurosurgical Pathophysiology, University Medical Centre of the Johannes Gutenberg University of Mainz Langenbeckstr. 1, 55131 Mainz, Germany; oliver.kempski@unimedizin-mainz.de
8 Department of Psychology, FOM University of Applied Sciences, 57078 Siegen, Germany
* Correspondence: oliver.hirsch@fom.de

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Abstract: Many countries introduced the requirement to wear masks in public spaces for containing SARS-CoV-2 making it commonplace in 2020. Up until now, there has been no comprehensive investigation as to the adverse health effects masks can cause. The aim was to find, test, evaluate and compile scientifically proven related side effects of wearing masks. For a quantitative evaluation, 44 mostly experimental studies were referenced, and for a substantive evaluation, 65 publications were found. The literature revealed relevant adverse effects of masks in numerous disciplines. In this paper, we refer to the psychological and physical deterioration as well as multiple symptoms described because of their consistent, recurrent and uniform presentation from different disciplines as a Mask-Induced Exhaustion Syndrome (MIES). We objectified evaluation evidenced changes in respiratory physiology of mask wearers with significant correlation of O_2 drop and fatigue ($p < 0.05$), a clustered co-occurrence of respiratory impairment and O_2 drop (67%), N95 mask and CO_2 rise (82%), N95 mask and O_2 drop (72%), N95 mask and headache (60%), respiratory impairment and temperature rise (88%), but also temperature rise and moisture (100%) under the masks. Extended mask-wearing by the general population could lead to relevant effects and consequences in many medical fields.

Keywords: personal protective equipment; masks; N95 face mask; surgical mask; risk; adverse effects; long-term adverse effects; contraindications; health risk assessment; hypercapnia; hypoxia; headache; dyspnea; physical exertion; MIES syndrome

1. Introduction

At the beginning of the spread of the novel pathogen SARS-CoV-2, it was necessary to make far-reaching decisions even without available explicit scientific data. The initial assumption was that the pandemic emergency measures were set in place to reduce the acute threat of the public health system effectively and swiftly.

In April 2020, the World Health Organization (WHO) recommended the use of masks only for symptomatic, ill individuals and health care workers and did not recommend its widespread use.

Exhibit viii

In June 2020, they changed this recommendation to endorse the general use of masks in, e.g., crowded places [1,2]. In a meta-analysis study commissioned by the WHO (evidence level Ia), no clear, scientifically graspable benefit of moderate or strong evidence was derived from wearing masks [3].

While maintaining a distance of at least one meter showed moderate evidence with regard to the spreading of SARS-CoV-2, only weak evidence at best could be found for masks alone in everyday use (non-medical setting) [3]. Another meta-analysis conducted in the same year confirmed the weak scientific evidence for masks [4].

Accordingly, the WHO did not recommend general or uncritical use of masks for the general population and expanded its risk and hazard list within just two months. While the April 2020 guideline highlighted the dangers of self-contamination, possible breathing difficulties and false sense of security, the June 2020 guideline found additional potential adverse effects such as headache, development of facial skin lesions, irritant dermatitis, acne or increased risk of contamination in public spaces due to improper mask disposal [1,2].

However, under pressure from increasing absolute numbers of positive SARS-CoV-2 tests, many prescribers further extended mask-wearing according to certain times and situations, always justified by the desire to limit the spread of the virus [5]. The media, numerous institutions and most of the population supported this approach.

Among the medical profession and scientists, the users and observers of medical devices, there have been simultaneous calls for a more nuanced approach [6–8]. While there has been a controversial scientific discussion worldwide about the benefits and risks of masks in public spaces, they became the new social appearance in everyday life in many countries at the same time.

Although there seems to be a consensus among the decision makers who have introduced mandatory masks that medical exemptions are warranted, it is ultimately the responsibility of individual clinicians to weigh up when to recommend exemption from mandatory masks. Physicians are in a conflict of interest concerning this matter. On the one hand, doctors have a leading role in supporting the authorities in the fight against a pandemic. On the other hand, doctors must, in accordance with the medical ethos, protect the interests, welfare and rights of their patient's third parties with the necessary care and in accordance with the recognized state of medical knowledge [9–11].

A careful risk–benefit analysis is becoming increasingly relevant for patients and their practitioners regarding the potential long-term effects of masks. The lack of knowledge of legal legitimacy on the one hand and of the medical scientific facts on the other is a reason for uncertainty among clinically active colleagues.

The aim of this paper is to provide a first, rapid, scientific presentation of the risks of general mandatory mask use by focusing on the possible adverse medical effects of masks, especially in certain diagnostic, patient and user groups.

2. Materials and Methods

The objective was to search for documented adverse effects and risks of different types of mouth–nose-covering masks. Of interest here were, on the one hand, readymade and self-manufactured fabric masks, including so-called community masks and, on the other hand medical, surgical and N95 masks (FFP2 masks).

Our approach of limiting the focus to negative effects seems surprising at first glance. However, such an approach helps toprovide us with more information. This methodology is in line with the strategy of Villalonga-Olives and Kawachi, who also conducted a review exclusively on the negative effects [12].

For an analysis of the literature, we defined the risk of mouth–nose protection as the description of symptoms or the negative effects of masks. Reviews and expert presentations from which no measurable values could be extracted, but which clearly present the research situation and describe negative effects, also fulfill this criterion.

Additionally, we defined the quantifiable, negative effect of masks as the presentation of a measured, statistically significant change in a physiological parameter in a pathological direction ($p < 0.05$), a statistically significant detection of symptoms ($p < 0.05$) or the occurrence of symptoms in at least 50% of those examined in a sample ($n \geq 50\%$).

Up to and including 31 October 2020, we conducted a database search in PubMed/MEDLINE on scientific studies and publications on adverse effects and risks of different types of mouth–nose-covering masks according to the criteria mentioned above (see Figure 1: Review flowchart). Terms searched were "face masks", "surgical mask" and "N95" in combination with the terms "risk" and "adverse effects" as well as "side effects". The selection criteria of the papers were based on our above definition of risk and adverse effect of masks. Mainly English- and German-language publications of evidence levels I to III according to the recommendations of the Agency for Healthcare Research and Quality (AHQR) that were not older than 20 years at the time of the review were considered. The evaluation also excluded level IV evidence, such as case reports and irrelevant letters to the editor that exclusively reflect opinions without scientific evidence.

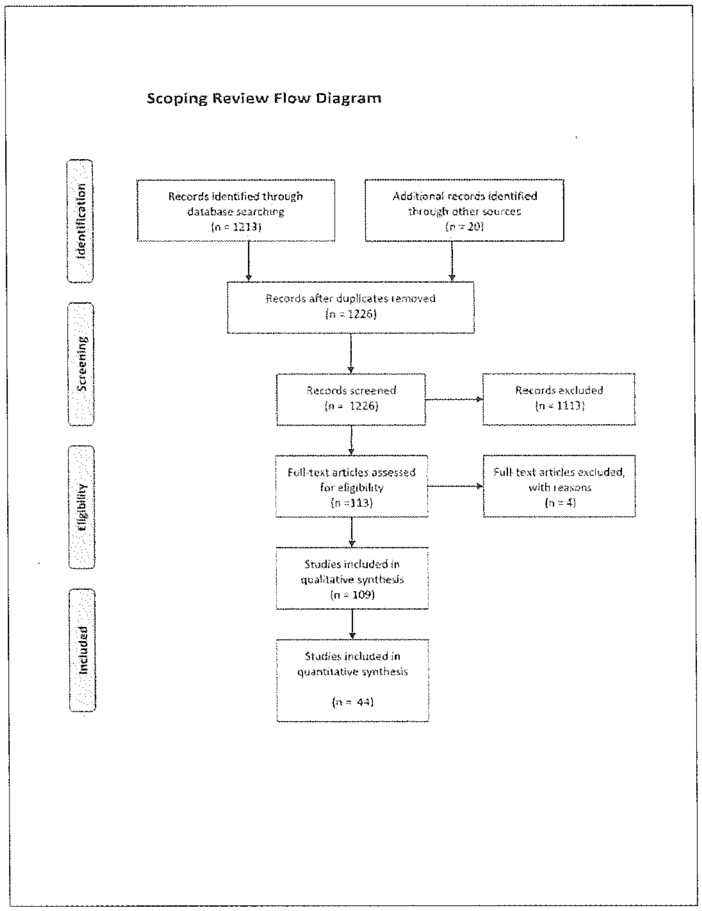

Figure 1. Scoping review flow diagram according to the PRISMA scheme.

After excluding 1113 papers that were irrelevant to the research question and did not meet the criteria mentioned (quantifiable, negative effects of masks, description of symptoms or the negative effects of masks), a total of 109 relevant publications were found for evaluation in the context of our scoping review (see Figure 1: Flow chart).

Sixty-five relevant publications concerning masks were considered being within the scope of the content-related evaluation. These included 14 reviews and 2 meta-analyses from the primary research. For the quantitative evaluation, 44 presentations of nega-

tive effects from the years 2004 to 2020 were eligible. Thirty-one of these studies were experimental (70%), and 13 studies were data collection studies in the sense of simple observational studies, especially in the dermatological field (30%). The observed study parameters and significant results from these 44 publications ($p < 0.05$ or $n \geq 50\%$) were compiled in an overall display (Figure 2). Based on this data, a correlation analysis of the observed mask effects was performed. This included a correlation calculation of the recorded symptoms and physiological changes (for nominally scaled, dichotomous variables according to Fisher using R, R Foundation for Statistical Computing, Vienna, Austria, version 4.0.2).

significantly measured mask-induced changes in scientific studies 2004-2020: ● = p<0.05 ■ = n≥50 %	Fabric Mask	Surgical Mask	N95-Mask	O2↓	CO2↑	Humidity↑	Temperature↑	Breathing Resistance↑	Respiratory Rate↑	Blood Pressure↑	Cerebral Vasodilation	Heart Rate↑	Respiratory Impairment	Exhaustion & Fatigue	Drowsiness	Dizziness	Headache	Psycho-vegetative Effect	Decrease in Empathy	Itch	Skin Irritation	Acne	Rhinitis	Voice Disorder	False Sense of Security	Bacterial Contamination	Fungal Contamination	Viral Contamination
Beder 2008		X		●								●																
Bharatendu 2020			X		●						●						●											
Butz 2005		X			●																							
Chughtai 2019		X																										●
Epstein 2020		X	X		●																							
Fikenzer 2020		X	X	●		●	●	●					●	●						●								
Foo 2006			X																	■	■	■						
Georgi 2020	X	X	X	●	●				●				●	●														
Goh 2019			X		■																							
Heider 2020		X	X																					●				
Hua 2020		X	X			●														■	●							
Jacobs 2009		X															●											
Jagim 2018	X			●										●	●													
Kao 2004			X	●					●				●	●														
Klimek 2020																							●					
Kyung 2020			X	●	●				●			●	●															
Lan 2020			X																	■	●							
Lee 2011			X					●																				
Li 2005		X	X			●	●	●		●		●	●	●						●								
Lim 2006			X														●											
Liu 2020	X	X	X	●		●	●					●	●	●	●	●					●							
Luckman 2020	X	X	X																						●			
Luksamijarulkul 2014		X																								●	●	
Matusiak 2020	X	X	X			●	●						●							●	●			●				
Mo 2020		X			●					●			●															
Monalisa 2017		X																								●	●	
Ong 2020			X														●											
Person 2018		X											●															
Pifarre 2020		X	X	●	●																							
Porcari 2016	X			●										●														
Prousa 2020	X	X	X															●										
Ramirez 2020		X	X														●											
Rebmann 2013		X	X	●	●							●	●	●	●		●											
Roberge 2012		X			●	●	●		●			●	●															
Roberge 2014			X		●		●																					
Rosner 2020		X	X														■				■	■						
Scarano 2020		X	X			●	●						●								●							
Shenal 2012	X	X	X											●														
Smart 2020		X	X				●						●															
Szepietkowski 2020	X	X	X																	●								
Techasatian 2020	X	X	X																		●							
Tong 2015			X	●	●																							
Wong 2013		X																	●									
Zhiqing 2018		X																								●		

Figure 2. Overview including all 44 considered studies with quantified, significant adverse effects of masks (black dots and black rectangles). Not all studies examined each mentioned parameter, as focused or subject-related questions were often in the foreground. Gray fields correspond to a lack of coverage in the primary studies, white fields represent measured effects. We found an often combination of significant chemical, physical, physiological parameters and complaints. Drowsiness summarizes the symptom for any qualitative neurological deficits described in the scientific literature examined.

In addition, another 64 publications with a neighboring range of topics were consulted in connection with the mask effects we found. These included declarations, guidelines

and legal principles. In order to expand the amount of data for the discussion, we proceeded according to the "snowball principle" by locating citations of selected papers in the bibliographies and including them where appropriate.

Since the findings from the topics presented for discussion were to an unexpected degree subject-related, we decided to divide the results according to the fields of medicine. Of course, there are overlaps between the respective fields, which we point out in detail.

3. Results

A total of 65 scientific papers on masks qualified for a purely content-based evaluation. These included 14 reviews and two meta-analyses.

Of the mathematically evaluable, groundbreaking 44 papers with significant negative mask effects ($p < 0.05$ or $n \geq 50\%$), 22 were published in 2020 (50%), and 22 were published before the COVID-19 pandemic. Of these 44 publications, 31 (70%) were of experimental nature, and the remainder were observational studies (30%). Most of the publications in question were English (98%). Thirty papers referred to surgical masks (68%), 30 publications related to N95 masks (68%), and only 10 studies pertained to fabric masks (23%).

Despite the differences between the primary studies, we were able to demonstrate a statistically significant correlation in the quantitative analysis between the negative side effects of blood-oxygen depletion and fatigue in mask wearers with $p = 0.0454$.

In addition, we found a mathematically grouped common appearance of statistically significant confirmed effects of masks in the primary studies ($p < 0.05$ and $n \geq 50\%$) as shown in Figure 2. In nine of the 11 scientific papers (82%), we found a combined onset of N95 respiratory protection and carbon dioxide rise when wearing a mask. We found a similar result for the decrease in oxygen saturation and respiratory impairment with synchronous evidence in six of the nine relevant studies (67%). N95 masks were associated with headaches in six of the 10 studies (60%). For oxygen deprivation under N95 respiratory protectors, we found a common occurrence in eight of 11 primary studies (72%). Skin temperature rise under masks was associated with fatigue in 50% (three out of six primary studies). The dual occurrence of the physical parameter temperature rise and respiratory impairment was found in seven of the eight studies (88%). A combined occurrence of the physical parameters temperature rise and humidity/moisture under the mask was found in 100% within six of six studies, with significant readings of these parameters (Figure 2).

The literature review confirms that relevant, undesired medical, organ and organ system-related phenomena accompanied by wearing masks occur in the fields of internal medicine (at least 11 publications, Section 3.2). The list covers neurology (seven publications, Section 3.3), psychology (more than 10 publications, Section 3.4), psychiatry (three publications, Section 3.5), gynecology (three publications, Section 3.6), dermatology (at least 10 publications, Section 3.7), ENT medicine (four publications, Section 3.8), dentistry (one publication, Section 3.8), sports medicine (four publications, Section 3.9), sociology (more than five publications, Section 3.10), occupational medicine (more than 14 publications, Section 3.11), microbiology (at least four publications, Section 3.12), epidemiology (more than 16 publications, Section 3.13), and pediatrics (four publications, Section 3.14) as well as environmental medicine (four publications, Section 3.15).

We will present the general physiological effects as a basis for all disciplines. This will be followed by a description of the results from the different medical fields of expertise and closing off with pediatrics the final paragraph.

3.1. *General Physiological and Pathophysiological Effects for the Wearer*

As early as 2005, an experimental dissertation (randomized crossover study) demonstrated that wearing surgical masks in healthy medical personnel (15 subjects, 18–40 years old) leads to measurable physical effects with elevated transcutaneous carbon dioxide values after 30 min [13]. The role of dead space volume and CO_2 retention as a cause of the significant change ($p < 0.05$) in blood gases on the way to hypercapnia, which was still

within the limits, was discussed in this article. Masks expand the natural dead space (nose, throat, trachea, bronchi) outwards and beyond the mouth and nose.

An experimental increase in the dead space volume during breathing increases carbon dioxide (CO_2) retention at rest and under exertion and correspondingly the carbon dioxide partial pressure pCO_2 in the blood ($p < 0.05$) [14].

As well as addressing the increased rebreathing of carbon dioxide (CO_2) due to the dead space, scientists also debate the influence of the increased breathing resistance when using masks [15–17].

According to the scientific data, mask wearers as a whole show a striking frequency of typical, measurable, physiological changes associated with masks.

In a recent intervention study conducted on eight subjects, measurements of the gas content for oxygen (measured in O_2 Vol%) and carbon dioxide (measured in CO_2 ppm) in the air under a mask showed a lower oxygen availability even at rest than without a mask. A Multi-Rae gas analyzer was used for the measurements (RaeSystems®) (Sunnyvale, California CA, United States). At the time of the study, the device was the most advanced portable multivariant real-time gas analyzer. It is also used in rescue medicine and operational emergencies. The absolute concentration of oxygen (O_2 Vol%) in the air under the masks was significantly lower (minus 12.4 Vol% O_2 in absolute terms, statistically significant with $p < 0.001$) at 18.3% compared to 20.9% room air concentration. Simultaneously, a health-critical value of carbon dioxide concentration (CO_2 Vol%) increased by a factor of 30 compared to normal room air was measured (ppm with mask versus 464 ppm without mask, statistically significant with $p < 0.001$) [18].

These phenomena are responsible for a statistically significant increase in carbon dioxide (CO_2) blood content in mask wearers [19,20], on the one hand, measured transcutaneously via an increased $PtcCO_2$ value [15,17,19,21,22], on the other hand, via end-expiratory partial pressure of carbon dioxide ($PETCO_2$) [23,24] or, respectively, the arterial partial pressure of carbon dioxide ($PaCO_2$) [25].

In addition to the increase in the wearer's blood carbon dioxide (CO_2) levels ($p < 0.05$) [13,15,17,19,21–28], another consequence of masks that has often been experimentally proven is a statistically significant drop in blood oxygen saturation (SpO_2) ($p < 0.05$) [18,19,21,23,29–34]. A drop in blood oxygen partial pressure (PaO_2) with the effect of an accompanying increase in heart rate ($p < 0.05$) [15,23,29,30,34] as well as an increase in respiratory rate ($p < 0.05$) [15,21,23,35,36] have been proven.

A statistically significant measurable increase in pulse rate ($p < 0.05$) and decrease in oxygen saturation SpO_2 after the first ($p < 0.01$) and second hour ($p < 0.0001$) under a disposable mask (surgical mask) were reported by researchers in a mask intervention study they conducted on 53 employed neurosurgeons [30].

In another experimental study (comparative study), surgical and N95 masks caused a significant increase in heart rate ($p < 0.01$) as well as a corresponding feeling of exhaustion ($p < 0.05$). These symptoms were accompanied by a sensation of heat ($p < 0.0001$) and itching ($p < 0.01$) due to moisture penetration of the masks ($p < 0.0001$) in 10 healthy volunteers of both sexes after only 90 min of physical activity [35]. Moisture penetration was determined via sensors by evaluating logs (SCXI-1461, National Instruments, Austin, TX, USA).

These phenomena were reproduced in another experiment on 20 healthy subjects wearing surgical masks. The masked subjects showed statistically significant increases in heart rate ($p < 0.001$) and respiratory rate ($p < 0.02$) accompanied by a significant measurable increase in transcutaneous carbon dioxide $PtcCO_2$ ($p < 0.0006$). They also complained of breathing difficulties during the exercise [15].

The increased rebreathing of carbon dioxide (CO_2) from the enlarged dead space volume in mask wearers can reflectively trigger increased respiratory activity with increased muscular work as well as the resulting additional oxygen demand and oxygen consumption [17]. This is a reaction to pathological changes in the sense of an adaptation effect. A mask-induced drop in blood oxygen saturation value (SpO_2) [30] or the blood

oxygen partial pressure (PaO_2) [34] can in turn additionally intensify subjective chest complaints [25,34].

The documented mask-induced changes in blood gases towards hypercapnia (increased carbon dioxide/CO_2 blood levels) and hypoxia (decreased oxygen/O_2 blood levels) may result in additional nonphysical effects such as confusion, decreased thinking ability and disorientation [23,36–39], including overall impaired cognitive abilities and decrease in psychomotoric abilities [19,32,38–41]. This highlights the importance of changes in blood gas parameters (O_2 and CO_2) as a cause of clinically relevant psychological and neurological effects. The above parameters and effects (oxygen saturation, carbon dioxide content, cognitive abilities) were measured in a study on saturation sensors (Semi-Tec AG, Therwil, Switzerland), using a Borg Rating Scale, Frank Scale, Roberge Respirator Comfort Scale and Roberge Subjective Symptoms-during-Work Scale, as well as with a Likert scale [19]. In the other main study, conventional ECG, capnography and symptom questionnaires were used in measuring carbon dioxide levels, pulse and cognitive abilities [23]. Other physiological data collection was done with pulse oximeters (Allegiance, MCGaw, USA), subjective complaints were assessed with a 5-point Likert scale and motoric speed was recorded with linear-position transducers (Tendo-Fitrodyne, Sport Machins, Trencin, Slovakia) [32]. Some researchers used standardized, anonymized questionnaires to collect data on subjective complaints associated with masks [37].

In an experimental setting with different mask types (community, surgical, N95) a significant increase in heart rate ($p < 0.04$), a decrease in oxygen saturation SpO_2 ($p < 0.05$) with an increase in skin temperature under the mask (face) and difficulty of breathing ($p < 0.002$) were recorded in 12 healthy young subjects (students). In addition, the investigators observed dizziness ($p < 0.03$), listlessness ($p < 0.05$), impaired thinking ($p < 0.03$) and concentration problems ($p < 0.02$), which were also statistically significant when wearing masks [29].

According to other researchers and their publications, masks also interfere with temperature regulation, impair the field of vision and of non-verbal and verbal communication [15,17,19,36,37,42–45].

The above-mentioned measurable and qualitative physiological effects of masks can have implications in various areas of expertise in medicine.

It is known from pathology that not only supra-threshold stimuli exceeding normal limits have disease-relevant consequences. Subthreshold stimuli are also capable of causing pathological changes if the exposure time is long enough. Examples occur from the slightest air pollution by hydrogen sulfide resulting in respiratory problems (throat irritation, coughing, reduced absorption of oxygen) and neurological diseases (headaches, dizziness) [46]. Furthermore, subthreshold but prolonged exposure to nitrogen oxides and particulate matter is associated with an increased risk of asthma, hospitalization and higher overall mortality [47,48]. Low concentrations of pesticides are also associated with disease-relevant consequences for humans such as mutations, development of cancer and neurological disorders [49]. Likewise, the chronic subthreshold intake of arsenic is associated with an increased risk of cancer [50], subthreshold intake of cadmium with the promotion of heart failure [51], subthreshold intake of lead is associated with hypertension, renal metabolic disorders and cognitive impairment [52] or subthreshold intake of mercury with immune deficiency and neurological disorders [53]. Subliminal UV radiation exposure over long periods is also known to cause mutation-promoting carcinogenic effects (especially white skin cancer) [54].

The mask-induced adverse changes are relatively minor at first glance, but repeated exposure over longer periods in accordance with the above-mentioned pathogenetic principle is relevant. Long-term disease-relevant consequences of masks are to be expected. Insofar, the statistically significant results found in the studies with mathematically tangible differences between mask wearers and people without masks are clinically relevant. They give an indication that with correspondingly repeated and prolonged exposure to physical, chemical, biological, physiological and psychological conditions, some of which are

subliminal, but which are significantly shifted towards pathological areas, health-reducing changes and clinical pictures can develop such as high blood pressure and arteriosclerosis, including coronary heart disease (metabolic syndrome) as well as neurological diseases. For small increases in carbon dioxide in the inhaled air, this disease-promoting effect has been proven with the creation of headaches, irritation of the respiratory tract up to asthma as well as an increase in blood pressure and heart rate with vascular damage and, finally, neuropathological and cardiovascular consequences [38]. Even slightly but persistently increased heart rates encourage oxidative stress with endothelial dysfunction, via increased inflammatory messengers, and finally, the stimulation of arteriosclerosis of the blood vessels has been proven [55]. A similar effect with the stimulation of high blood pressure, cardiac dysfunction and damage to blood vessels supplying the brain is suggested for slightly increased breathing rates over long periods [56,57]. Masks are responsible for the aforementioned physiological changes with rises in inhaled carbon dioxide [18–28], small sustained increases in heart rate [15,23,29,30,35] and mild but sustained increases in respiratory rates [15,21,23,34,36].

For a better understanding of the side effects and dangers of masks presented in this literature review, it is possible to refer to well-known principles of respiratory physiology (Figure 3).

The average dead space volume during breathing in adults is approximately 150–180 mL and is significantly increased when wearing a mask covering the mouth and nose [58]. With an N95 mask, for example, the dead space volume of approximately 98–168 mL was determined in an experimental study [59]. This corresponds to a mask-related dead space increase of approximately 65 to 112% for adults and, thus, almost a doubling. At a respiratory rate of 12 per minute, the pendulum volume respiration with such a mask would, thus, be at least 2.9–3.8 L per minute. Therefore, the dead space amassed by the mask causes a relative reduction in the gas exchange volume available to the lungs per breath by 37% [60]. This largely explains the impairment of respiratory physiology reported in our work and the resulting side effects of all types of masks in everyday use in healthy and sick people (increase in respiratory rate, increase in heart rate, decrease in oxygen saturation, increase in carbon dioxide partial pressure, fatigue, headaches, dizziness, impaired thinking, etc.) [36,58].

In addition to the effect of increased dead space volume breathing, however, mask-related breathing resistance is also of exceptional importance (Figure 3) [23,36].

Experiments show an increase in airway resistance by a remarkable 126% on inhalation and 122% on exhalation with an N95 mask [60]. Experimental studies have also shown that moisturization of the mask (N95) increases the breathing resistance by a further 3% [61] and can, thus, increase the airway resistance up to 2.3 times the normal value.

This clearly shows the importance of the airway resistance of a mask. Here, the mask acts as a disturbance factor in breathing and makes the observed compensatory reactions with an increase in breathing frequency and simultaneous feeling of breathlessness plausible (increased work of the respiratory muscles). This extra strain due to the amplified work of breathing against bigger resistance caused by the masks also leads to intensified exhaustion with a rise in heart rate and increased CO_2 production. Fittingly, in our review of the studies on side effects of masks (Figure 2), we also found a percentage clustering of significant respiratory impairment and a significant drop in oxygen saturation (in about 75% of all study results).

In the evaluation of the primary papers, we also determined a statically significant correlation of the drop in oxygen saturation (SpO_2) and fatigue with a common occurrence in 58% of the mask use studies with significant results (Figure 2, $p < 0.05$).

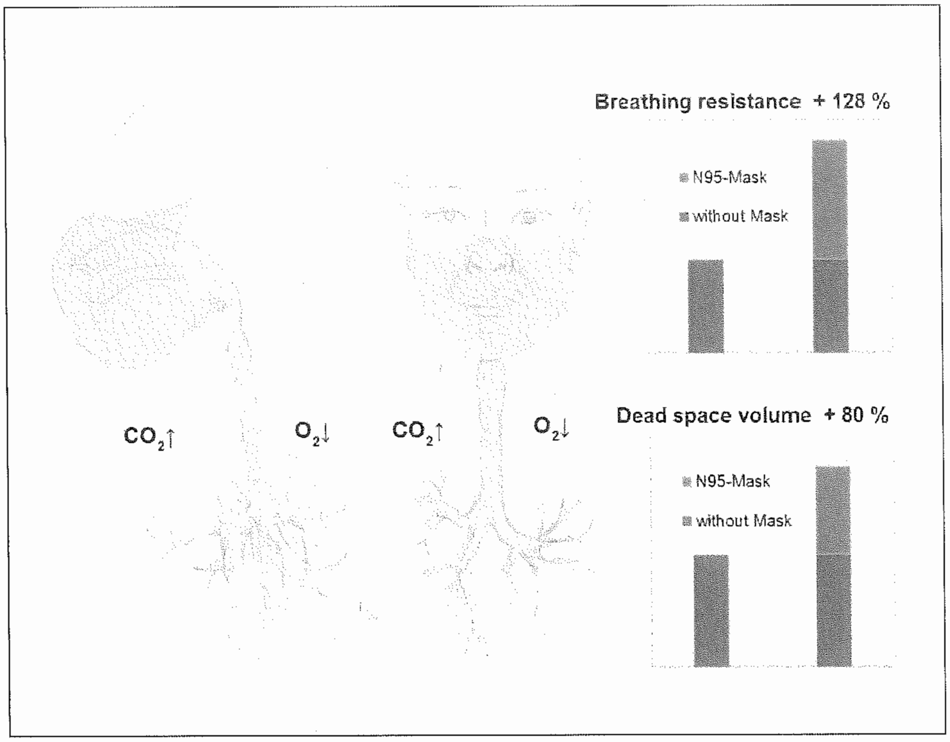

Figure 3. Pathophysiology of the mask (important physical and chemical effects): Illustration of the breathing resistance* and of the dead space volume of an N95 mask in an adult. When breathing, there is an overall significantly reduced possible gas exchange volume of the lungs of minus 37% caused by the mask (Lee 2011) [60] according to a decrease in breathing depth and volume due to the greater breathing resistance of plus128%* (exertion when inhaling greater than when exhaling) and due to the increased dead space volume of plus80%**, which does not participate directly in the gas exchange and is being only partially mixed with the environment. (* = averaged inspiration and expiration according to Lee 2011 [60] including moisture penetration according to Roberge 2010 [61], ** = averaged values according to Xu 2015 [59]).

3.2. *Internistic Side Effects and Dangers*

As early as 2012, an experiment showed that walking in the 20 masked subjects compared to the identical activity without masks significantly increased heart rates (average +9.4 beats per minute, $p < 0.001$) and breathing rates ($p < 0.02$). These physiological changes were accompanied by transcutaneous significantly measurable increased transcutaneous carbon dioxide ($PtcCO_2$) levels ($p < 0.0006$) as well as respiratory difficulties in the mask wearers compared to the control group [15].

In a recent experimental comparative study from 2020, 12 healthy volunteers under surgical masks as well as under N95 masks experienced measurable impairments in the measured lung function parameters as well as cardiopulmonary capacity (lower maximum blood lactate response) during moderate to heavy physical exertion compared to exertion without masks ($p < 0.001$) [31]. The mask-induced increased airway resistance led to increased respiratory work with increased oxygen consumption and demand, both of the respiratory muscles and the heart. Breathing was significantly impeded ($p < 0.001$) and participants reported mild pain. The scientists concluded from their results that the cardiac compensation of the pulmonary, mask-induced restrictions, which still functioned in healthy people, was probably no longer possible in patients with reduced cardiac output [31].

In another recent study, researchers tested fabric masks (community masks), surgical masks and FFP2/N95 masks in 26 healthy people during exercise on a cycle ergometer. All

masks also showed a measurable carbon dioxide (CO_2) retention ($PtcCO_2$) (statistically significant with $p < 0.001$) and, for N95 masks, a decrease in the oxygen saturation value SpO_2 (statistically significant at 75 and 100 W with $p < 0.02$ and $p < 0.005$, respectively). The clinical relevance of these changes was shown in an increase in breathing frequency with fabric masks ($p < 0.04$) as well as in the occurrence of the previously described mask-specific complaints such as a feeling of heat, shortness of breath and headaches. The stress perception was recorded on a Borg scale from 1 to 20. During physical exertion under an N95 mask, the group with masks showed a significant increase in the feeling of exhaustion compared to the group without with 14.6 versus 11.9 on the scale of 20. During the exposure, 14 of the 24 subjects wearing masks complained of shortness of breath (58%), four of headaches and two of a feeling of heat. Most of the complaints concerned FFP2 masks (72%) [21].

The aforementioned physiological and subjective physical effects of masks on healthy people at rest and under exertion [21,31] give an indication of the effect of masks on sick and elderly people even without exertion.

In an observational study of ten 20 to 50 year-old nurses wearing N95 masks during their shift work, side effects such as breathing difficulties ("I can't breathe"), feelings of exhaustion, headache ($p < 0.001$), drowsiness ($p < 0.001$) and a decrease in oxygen saturation SpO_2 ($p < 0.05$) as well as an increase in heart rate ($p < 0.001$) were statistically significant in association with an increase in obesity (BMI) [19]. The occurrence of symptoms under masks was also associated with older age (statistically significant correlation of fatigue and drowsiness with $p < 0.01$ each, nausea with $p < 0.05$, an increase in blood pressure with $p < 0.01$, headache with $p < 0.05$, breathing difficulties with $p < 0.001$) [19].

In an intervention study involving 97 patients with advanced chronic obstructive pulmonary disease (COPD) the respiratory rate, oxygen saturation and exhaled carbon dioxide equivalents (capnometry) changed unfavorably and significantly after the use of N95 masks (FFP2 equivalent) with an initial 10-minute rest and subsequent 6-minute walking. Seven patients discontinued the experiment due to serious complaints with a decrease in the oxygen saturation value SpO_2 and a pathological carbon dioxide (CO_2) retention as well as increased end-expiratory partial pressure of carbon dioxide ($PETCO_2$) [23]. In two patients, the $PETCO_2$ exceeded the normal limits and reached values of >50 mmHg. An FEV1 < 30% and a modified Medical Research Council (mMRC) Dyspnea Scale Score of ≥ 3, both indicators of advanced COPD, correlated with mask intolerance overall in this study. The most common symptom under mask was breathlessness at 86%. In the dropouts of the study, dizziness (57%) and headaches were also often recorded. In the mask-tolerant COPD patients, significant increases in heart rate, respiratory rate and end-expiratory carbon dioxide partial pressure $PETCO_2$ could be objectified even at rest, after only 10 min of mask-wearing ($p < 0.001$), accompanied by a decrease in oxygen saturation SpO_2 ($p < 0.001$) [23]. The results of this study with an evidence level IIa are indicative for COPD mask wearers.

In another retrospective comparative study on COPD and surgical masks, examiners were able to demonstrate statistically an increase in arterial partial pressure of carbon dioxide ($PaCO_2$) of approximately +8 mmHg ($p < 0.005$) and a concomitant mask-related increase in systolic blood pressure of +11 mmHg ($p < 0.02$) [25]. This increase is relevant in hypertensive patients, but also in healthy people with borderline blood pressure values as pathological value range triggered by mask-wearing can be induced.

In 39 hemodialysis patients with end-stage renal disease, a type N95 mask (FFP2 equivalent) caused a significant drop in blood oxygen partial pressure (PaO_2) in 70% of patients at rest (on hemodialysis) within only 4 h ($p = 0.006$). Despite a compensatory increased respiratory rate ($p < 0.001$), malaise with chest pain occurred ($p < 0.001$) and even resulted in hypoxemia (drop in oxygen below the normal limit) in 19% of the subjects [34]. The researchers concluded from their findings that elderly or patients with reduced cardiopulmonary function have a higher risk of developing a severe respiratory failure while wearing a mask [34].

In a review paper on the risks and benefits of masks worn during the COVID-19 crisis, other authors provide an equally critical assessment of mandatory mask use for patients with pneumonia, both with and without COVID-19 pneumonia disease [16].

3.3. Neurological Side Effects and Dangers

In a scientific evaluation of syncope in the operating theatre, 36 of 77 affected persons (47%) were associated with wearing a mask [62]. However, other factors could not be ruled out as contributory causes.

In their level III evidence review, neurologists from Israel, the UK and the USA state that a mask is unsuitable for epileptics because it can trigger hyperventilation [63]. The use of a mask significantly increases the respiratory rate by about plus 15 to 20% [15,21,23,34,64]. However, an increase in breathing frequency leading to hyperventilation is known to be used for provocation in the diagnosis of epilepsy and causes seizure-equivalent EEG changes in 80% of patients with generalized epilepsy and in up to 28% of focal epileptics [65].

Physicians from New York studied the effects of wearing masks of the surgical-type mask and N95 among medical personnel in a sample of 343 participants (surveyed using standardized, anonymized questionnaires). Wearing the masks caused detectable physical adverse effects such as impaired cognition (24% of wearers) and headaches in 71.4% of the participants. Of these, 28% persisted and required medication. Headache occurred in 15.2% under 1 h of wear, in 30.6% after 1 h of wear and in 29.7% after 3 h of wear. Thus, the effect intensified with increasing wearing time [37].

Confusion, disorientation and even drowsiness (Likert scale questionnaire) and reduced motoric abilities (measured with a linear position transducer) with reduced reactivity and overall impaired performance (measured with the Roberge Subjective Symptoms-during-Work Scale) as a result of mask use have also been documented in other studies [19,23,29,32,36,37].

The scientists explain these neurological impairments with a mask-induced latent drop in blood gas oxygen levels O_2 (towards hypoxia) or a latent increase in blood gas carbon dioxide levels CO_2 (towards hypercapnia) [36]. In view of the scientific data, this connection also appears to be indisputable [38–41].

In a mask experiment from 2020, significant impaired thinking ($p < 0.03$) and impaired concentration ($p < 0.02$) were found for all mask types used (fabric, surgical and N95 masks) after only 100 min of wearing the mask [29]. The thought disorders correlated significantly with a drop in oxygen saturation ($p < 0.001$) during mask use.

Initial headaches ($p < 0.05$) were experienced by up to 82% of 158, 21–35 year-old mask wearers in another study of N95 respiratory protection with one third (34%) experiencing headaches up to four times daily. Participants wore the mask for 18.3 days over a 30-day period with a mean of 5.9 h per day [66].

Significantly increased headache ($p < 0.05$) could be observed not only for N95 but also for surgical masks in participants of another observational study of health care workers [67].

In another study, the researchers classified 306 users with an average age of 43 years and wearing different types of masks, of whom 51% had an initial headache as a specific symptom related exclusively to increased surgical and N95 mask use (1 to 4 h, $p = 0.008$) [68].

Researchers from Singapore were able to demonstrate in a trial involving 154 healthy N95 health service mask wearers that a significant increase in mask-induced blood carbon dioxide levels (measured by end-expiratory partial pressure of carbon dioxide $PETCO_2$) and a measurably greater vasodilatation with an increase in cerebral artery flow in the cerebri media resulted. This was associated with headaches in the trial group ($p < 0.001$) [27].

According to the researchers, the aforementioned changes also contribute to headaches during the prolonged use of masks with a shift towards hypoxia and hypercapnia. Furthermore, stress and mechanical factors such as the irritation of cervical nerves in the neck and head area caused by the tight mask straps pressuring the nerve strands also contribute to headaches [66].

In the analysis of the primary studies, we were able to detect an association between the N95 mask and headaches. In six out of 10 studies, the significant headache appeared in conjunction with the N95 mask (60% of all studies, Figure 2).

3.4. Psychological Side Effects and Dangers

According to an experimental study, wearing surgical masks and N95 masks can also lead to a reduced quality of life owing to reduced cardiopulmonary capacity [31]. Masks, along with causing physiological changes and discomfort with progressive length of use, can also lead to significant discomfort ($p < 0.03$ to $p < 0.0001$) and a feeling of exhaustion ($p < 0.05$ to 0.0001) [69].

Besides the shift in blood gases towards hypercapnia (increase in CO_2) and hypoxia (decrease in O_2), detailed under general physiological effects (Section 3.1), masks also restrict the cognitive abilities of the individual (measured using a Likert scale survey) accompanied by a decline in psycho-motoric abilities and consequently a reduced responsiveness (measured using a linear position transducer) as well as an overall reduced performance capability (measured with the Roberge Subjective Symptoms-during-Work Scale) [29,32,38,39,41].

The mask also causes an impaired field of vision (especially affecting the ground and obstacles on the ground) and also presents an inhibition to habitual actions such as eating, drinking, touching, scratching and cleaning the otherwise uncovered part of the face, which is consciously and subconsciously perceived as a permanent disturbance, obstruction and restriction [36]. Wearing masks, thus, entails a feeling of deprivation of freedom and loss of autonomy and self-determination, which can lead to suppressed anger and subconscious constant distraction, especially as the wearing of masks is mostly dictated and ordered by others [70,71]. These perceived interferences of integrity, self-determination and autonomy, coupled with discomfort, often contribute to substantial distraction and may ultimately be combined with the physiologically mask-related decline in psycho-motoric abilities, reduced responsiveness and an overall impaired cognitive performance. It leads to misjudging situations as well as delayed, incorrect and inappropriate behavior and a decline in the effectiveness of the mask wearer [36,37,39–41].

The use of masks for several hours often causes further detectable adverse effects such as headaches, local acne, mask-associated skin irritation, itching, sensations of heat and dampness, impairments and discomfort predominantly affecting the head and face [19,29,35–37,71–73]. However, the head and face are significant for well-being due to their large representation in the sensitive cerebral cortex (homunculus) [36].

According to a questionnaire survey, masks also frequently cause anxiety and psycho-vegetative stress reactions in children—as well as in adults—with an increase in psychosomatic and stress-related illnesses and depressive self-experience, reduced participation, social withdrawal and lowered health-related self-care [74]. Over 50% of the mask wearers studied had at least mild depressive feelings [74]. Additional fear-inducing and often exaggerated media coverage can further intensify this. A recent retrospective analysis of the general media in the context of the 2014 Ebola epidemic showed a scientific truth content of only 38% of all publicly published information [75]. Researchers classified a total of 28% of the information as provocative and polarizing and 42% as exaggerating risks. In addition, 72% of the media content aimed to stir up health-related negative feelings. The feeling of fear, combined with insecurity and the primal human need to belong [76], causes a social dynamic that seems partly unfounded from a medical and scientific point of view.

The mask, which originally served purely hygienic purpose, has been transformed into a symbol of conformity and pseudo-solidarity. The WHO, for example, lists the advantages of the use of masks by healthy people in public to include a potentially reduced stigmatization of mask wearers, a sense of contribution to preventing the spread of the virus and a reminder to comply with other measures [2].

3.5. Psychiatric Side Effects and Dangers

As explained earlier, masks can cause increased rebreathing with an accumulation of carbon dioxide in the wearer due to increased dead space volume [16–18,20] (Figure 3), with often statistically significant measurable elevated blood carbon dioxide (CO2) levels in sufferers [13,15,17,19–28] (Figure 2). However, changes that lead to hypercapnia are known to trigger panic attacks [77,78]. This makes the significantly measurable increase in CO_2 caused by wearing a mask clinically relevant.

Interestingly, breath provocation tests by inhaling CO_2 are used to differentiate anxiety states in panic disorders and premenstrual dysphoria from other psychiatric clinical pictures. Here, absolute concentrations of 5% CO_2 already suffice to trigger panic reactions within 15–16 min [77]. The normal exhaled air content of CO_2 is about 4%.

It is obvious from experimental studies on masked subjects that concentration changes in the respiratory gases in the above-mentioned range with values above 4% could occur during rebreathing with prolonged mask use [18,23].

The activation of the locus coeruleus by CO_2 is used to generate panic reactions via respiratory gases [78,79]. This is because the locus coeruleus is an important part of the system of vegetative noradrenergic neurons, a control center in the brainstem, which reacts to an appropriate stimulus and changes in the gas concentrations in the blood by releasing the stress hormone noradrenaline [78].

From the physiological, neurological and psychological side effects and dangers described above (Sections 3.1, 3.3 and 3.4), additional problems can be derived for the use of masks in psychiatric cases. People undergoing treatment for dementia, paranoid schizophrenia, personality disorders with anxiety and panic attacks, but also panic disorders with claustrophobic components, are difficult to reconcile with a mask requirement, because even small increases in CO_2 can cause and intensify panic attacks [44,77–79].

According to a psychiatric study, patients with moderate to severe dementia have no understanding of COVID-19 protection measures and have to be persuaded to wear masks constantly [80].

According to a comparative study, patients with schizophrenia have a lower acceptance of mask-wearing (54.9% agreement) than ordinary practice patients (61.6%) [81]. The extent to which mask-wearing can lead to an exacerbation of schizophrenia symptoms has not yet been researched in detail.

When wearing masks, confusion, impaired thinking, disorientation (standardized recording via special rating and Likert scales, $p < 0.05$) and in some cases a decrease in maximum speed and reaction time (measured with the linear-position transducer, $p < 0.05$) were observed [19,32,36,38–41]. Psychotropic drugs reduce psycho-motoric functions in psychiatric patients. This can become clinically relevant especially with regard to the further reduced ability to react and the additional increased susceptibility to accidents of such patients when wearing masks.

In order to avoid an unintentional CO_2-triggered anesthesia [39], fixed and medically sedated patients, without the possibility of continuous monitoring, should not be masked according to the criteria of the Centers for Disease Control and Prevention, USA (CDC). This is because of the possible CO_2 retention described above, as there is a risk of unconsciousness, aspiration and asphyxia [16,17,20,38,82,83].

3.6. Gynaecological Side Effects and Dangers

As a critical variable, a low blood carbon dioxide level in pregnant women is maintained via an increased respiratory minute volume, stimulated by progesterone [22]. For a pregnant woman and her unborn child, there is a metabolic need for a fetal–maternal carbon dioxide (CO_2) gradient. The mother's blood carbon dioxide level should always be lower than that of the unborn child in order to ensure the diffusion of CO_2 from the fetal blood into the maternal circulation via the placenta.

Therefore, mask-related phenomena described above (Sections 3.1 and 3.2), such as the measurable changes in respiratory physiology with increased breathing resistance,

increased dead space volume (Figure 3) and the retention of exhaled carbon dioxide (CO_2) are of importance. If CO_2 is increasingly rebreathed under masks, this manifestation could, even with subliminal carbon dioxide increases, act as a disturbing variable of the fetal–maternal CO_2 gradient increasing over time of exposure and, thus, develop clinical relevance, also with regard to a reduced compensation reserve of the expectant mothers [20,22,28].

In a comparative study, 22 pregnant women wearing N95 masks during 20 min of exercise showed significantly higher percutaneous CO_2 values, with average $PtcCO_2$ values of 33.3 mmHg compared to 31.3 mmHg than in 22 pregnant women without masks ($p = 0.04$) [22]. The heat sensation of the expectant mothers was also significantly increased with masks, with $p < 0.001$ [22].

Accordingly, in another intervention study, researchers demonstrated that breathing through an N95 mask (FFP2 equivalent) impeded gas exchange in 20 pregnant women at rest and during exercise, causing additional stress on their metabolic system [28]. Thus, under an N95 mask, 20 pregnant women showed a decrease in oxygen uptake capacity VO_2 of about 14% (statistically significant, $p = 0.013$) and a decrease in carbon dioxide output capacity VCO_2 of about 18% (statistically significant, $p = 0.001$). Corresponding significant changes in exhaled oxygen and carbon dioxide equivalents were also documented with increases in exhaled carbon dioxide ($FeCO_2$) ($p < 0.001$) and decreases in exhaled oxygen (FeO_2) ($p < 0.001$), which were explained by an altered metabolism due to respiratory mask obstruction [28].

In experiments with predominantly short mask application times, neither the mothers nor the fetuses showed statistically significant increases in heart rates or changes in respiratory rates and oxygen saturation values. However, the exact effects of prolonged mask use in pregnant women remain unclear overall. Therefore, in pregnant women, extended use of surgical and N95 masks is viewed critically [20].

In addition, it is unclear whether the substances contained in industrially manufactured masks that can be inhaled over longer periods of time (e.g., formaldehyde as an ingredient of the textile and thiram as an ingredient of the ear bands) are teratogenic [20,84].

3.7. Dermatological Side Effects and Dangers

Unlike garments worn over closed skin, masks cover body areas close to the mouth and nose, i.e., body parts that are involved with respiration.

Inevitably, this leads not only to a measurable temperature rise [15,44,85], but also to a severe increase in humidity due to condensation of the exhaled air, which in turn changes the natural skin milieu considerably of perioral and perinasal areas [36,61,82]. It also increases the redness, pH-value, fluid loss through the skin epithelium, increased hydration and sebum production measurably [73]. Preexisting skin diseases are not only perpetuated by these changes, but also exacerbated. In general, the skin becomes more susceptible to infections and acne.

The authors of an experimental study were able to prove a disturbed barrier function of the skin after only 4 h of wearing a mask in 20 healthy volunteers, both for surgical masks and for N95 masks [73]. In addition, germs (bacteria, fungi and viruses) accumulate on the outside and inside of the masks due to the warm and moist environment [86–89]. They can cause clinically relevant fungal, bacterial or viral infections. The unusual increase in the detection of rhinoviruses in the sentinel studies of the German Robert Koch Institute (RKI) from 2020 [90] could be another indication of this phenomenon.

In addition, a region of the skin that is not evolutionarily adapted to such stimuli is subjected to increased mechanical stress. All in all, the above-mentioned facts cause the unfavorable dermatological effects with mask related adverse skin reactions like acne, rashes on the face and itch symptoms [91].

A Chinese research group reported skin irritation and itching when using N95 masks among 542 test participants and also a correlation between the skin damage that occurred and the time of exposure (68.9% at ≤6 h/day and 81.7% at >6 h/day) [92].

A New York study evaluated in a random sample of 343 participants the effects of frequent wearing of surgical mask type and N95 masks among healthcare workers during the COVID-19 pandemic. Wearing the masks caused headache in 71.4% of participants, in addition to drowsiness in 23.6%, detectable skin damage in 51% and acne in 53% of mask users [37].

On the one hand, direct mechanical skin lesions occur on the nose and cheekbones due to shear force, especially when masks are frequently put on and taken off [37,92].

On the other hand, masks create an unnaturally moist and warm local skin environment [29,36,82]. In fact, scientists were able to demonstrate a significant increase in humidity and temperature in the covered facial area in another study in which the test individuals wore masks for one hour [85]. The relative humidity under the masks was measured with a sensor (Atmo-Tube, San Francisco, CA, USA). The sensation of humidity and temperature in the facial area is more crucial for well-being than other body regions [36,44]. This can increase discomfort under the masks. In addition, the increase in temperature favors bacterial optimization.

The pressure of the masks also causes an obstruction of the flow physiology of lymph and blood vessels in the face, with the consequence of increased disturbance of skin function [73] and ultimately also contributing to acne in up to 53% of all wearers and other skin irritations in up to 51% of all wearers [36,37,82].

Other researchers examined 322 participants with N95 masks in an observational study and detected acne in up to 59.6% of them, itching in 51.4% and redness in 35.8% as side effects [72].

In up to 19.6% (273) of the 1393 wearers of different masks (community masks, surgical, N95 masks), itching could be objectified in one study, in 9% even severely. An atopic predisposition (allergy tendency) correlated with the risk of itching. The length of use was significantly related to the risk of itching ($p < 0.0001$) [93].

In another dermatological study from 2020, 96.9% of 876 users of all mask types (community masks, surgical masks, N95 masks) confirmed adverse problems with a significant increase in itching (7.7%), accompanied by fogging-up of glasses (21.3%), flushing (21.3%), slurred speech (12.3%) and difficulty breathing (35.9%) ($p < 0.01$) [71].

Apart from an increased incidence of acne [37,72,91] under masks, contact eczema and urticaria [94] are generally described in connection with hypersensitivities to ingredients of the industrially manufactured masks (surgical mask and N95) such as formaldehyde (ingredient of the textile) and thiram (ingredient of the ear bands) [73,84]. The hazardous substance thiram, originally a pesticide and corrosive, is used in the rubber industry as a optimization accelerator. Formaldehyde is a biocide and carcinogen and is used as a disinfectant in the industry.

Even isolated permanent hyperpigmentation as a result of post-inflammatory or pigmented contact dermatitis has been described by dermatologists after prolonged mask use [72,91].

3.8. ENT and Dental Side Effects and Dangers

There are reports from dental communities about negative effects of masks and are accordingly titled "mask mouth" [95]. Provocation of gingivitis (inflammation of the gums), halitosis (bad breath), candidiasis (fungal infestation of the mucous membranes with Candida albicans) and cheilitis (inflammation of the lips), especially of the corners of the mouth, and even plaque and caries are attributed to the excessive and improper use of masks. The main trigger of the oral diseases mentioned is an increased dry mouth due to a reduced saliva flow and increased breathing through the open mouth under the mask. Mouth breathing causes surface dehydration and reduced salivary flow rate (SFR) [95]. Dry mouth is scientifically proven due to mask wear [29]. The bad habit of breathing through the open mouth while wearing a mask seems plausible because such breathing pattern compensates for the increased breathing resistance, especially when inhaling through the masks [60,61]. In turn, the outer skin moisture [71,73,85] with altered

skin flora, which has already been described under dermatological side effects (Section 3.7), is held responsible as an explanation for the inflammation of the lips and corners of the mouth (cheilitis) [95]. This clearly shows the disease-promoting reversal of the natural conditions caused by masks. The physiological internal moisture with external dryness in the oral cavity converts into internal dryness with external moisture.

ENT physicians recently discovered a new form of irritant rhinitis due to N95 mask use in 46 patients. They performed endoscopies and nasal irrigations on mask wearers, which were subsequently assessed pathologically. Clinical problems were recorded with standardized questionnaires. They found statistically significant evidence of mask-induced rhinitis and itching and swelling of the mucous membranes as well as increased sneezing ($p < 0.01$). Endoscopically, it showed an increased secretion and evidence of inhaled mask polypropylene fibers as the trigger of mucosal irritation [96].

In a study of 221 health care workers, ENT physicians objectified a voice disorder in 33% of mask users. The VHI-10 score of 1 to 10, which measures voice disorders, was on average 5.72 higher in these mask users (statistically significant with $p < 0.001$). The mask not only acted as an acoustic filter, provoking excessively loud speech, it also seems to trigger impaired vocal cord coordination because the mask compromises the pressure gradients required for undisturbed speech [43]. The researchers concluded from their findings that masks could pose a potential risk of triggering new voice disorders as well as exacerbating existing ones.

3.9. Sports Medicine Side Effects and Dangers

According to the literature, performance-enhancing effects of masks regarding cardiovascular optimization and improvement of oxygen uptake capacity cannot be proven.

For example, in an experimental reference study (12 subjects per group), the training mask that supposedly mimics altitude training (ETM: elevation training mask) only had training effects on the respiratory muscles. However, mask wearers showed significantly lower oxygen saturation values (SpO_2%) during exercise (SpO_2 of 94% for mask wearers versus 96% for mask-less, $p < 0.05$) [33], which can be explained by an increased dead space volume and increased resistance during breathing. The measured oxygen saturation values were significantly lower than the normal values in the group of mask wearers, which indicates a clinical relevance.

The proven adaptation effect of the respiratory muscles in healthy athletes [33] clearly suggests that masks have a disruptive effect on respiratory physiology.

In another intervention study on mask use in weightlifters, researchers documented statistically significant effects of reduced attention (questionnaire recording, Likert scale) and a slowed maximum speed of movement detectable by means of sensors (both significant at $p < 0.001$), leading the researchers to conclude that mask use in sport is not without risks. As a secondary finding, they also detected a significant decrease in oxygen saturation SpO_2 when performing special weight-lifting exercises ("back squats") in the mask group after only 1 min of exercise compared to the mask-free group ($p < 0.001$) [32]. The proven tendency of the masks to shift the chemical parameter oxygen saturation SpO_2 in a pathological direction (lower limit value 95%) may well have clinical relevance in untrained or sick individuals.

Sports medicine confirmed an increase in carbon dioxide (CO_2) retention, with an elevation in CO_2 partial pressure in the blood with larger respiratory dead space volumes [14].

In fact, dead space-induced CO_2 retention while wearing a mask during exercise was also experimentally proven. The effects of a short aerobic exercise under N95 masks were tested on 16 healthy volunteers. A significantly increased end-expiratory partial pressure of carbon dioxide ($PETCO_2$) with plus 8 mmHg ($p < 0.001$) was found [24]. The increase in blood carbon dioxide (CO_2) in the mask wearers under maximum load was plus 14% CO_2 for surgical masks and plus 23% CO_2 for N95 masks, an effect that may well have clinical relevance in the pre-diseased, elderly and children, as these values strongly approached the pathological range [24].

In an interesting endurance study with eight middle-aged subjects (19–66), the gas content for O_2 and CO_2 under the masks was determined before and after exercise. Even at rest, the oxygen availability under the masks was 13% lower than without the masks and the carbon dioxide (CO_2) concentration was 30 times higher. Under stress (Ruffier test), the oxygen concentration (% O_2) below the mask dropped significantly by a further 3.7%, while the carbon dioxide concentration (% CO_2) increased significantly by a further 20% (statistically significant with $p < 0.001$). Correspondingly, the oxygen saturation of the blood (SpO_2) of the test persons also decreased significantly from 97.6 to 92.1% ($p < 0.02$) [18]. The drop in the oxygen saturation value (SpO_2) to 92%, clearly below the normal limit of 95%, is to be classified as clinically relevant and detrimental to health.

These facts are an indication that the use of masks also triggers the effects described above leading to hypoxia and hypercapnia in sports. Accordingly, the WHO and Centers for Disease Control and Prevention, GA, USA (CDC) advise against wearing masks during physical exercise [82,97].

3.10. Social and Sociological Side Effects and Dangers

The results of a Chilean study with health care workers show that masks act like an acoustic filter and provoke excessively loud speech. This causes a voice disorder [43]. The increased volume of speech also contributes to increased aerosol production by the mask wearer [98]. These experimental data measured with the Aerodynamic Particle Sizer (APS, TSI, model 332, TSI Incorporated, Minnesota, MI, USA) are highly relevant.

Moreover, mask wearers are prevented from interacting normally in everyday life due to impaired clarity of speech [45], which tempts them to get closer to each other.

This results in a distorted prioritization in the general public, which counteracts the recommended measures associated with the COVID-19 pandemic. The WHO prioritizes social distancing and hand hygiene with moderate evidence and recommends wearing a mask with weak evidence, especially in situations where individuals are unable to maintain a physical distance of at least 1 m [3].

The disruption of non-verbal communication due to the loss of facial expression recognition under the mask can increase feelings of insecurity, discouragement and numbness as well as isolation, which can be extremely stressful for the mentally and hearing-impaired [16].

Experts point out that masks disrupt the basics of human communication (verbal and nonverbal). The limited facial recognition caused by masks leads to a suppression of emotional signals. Masks, therefore, disrupt social interaction, erasing the positive effect of smiles and laughter but at the same time greatly increasing the likelihood of misunderstandings because negative emotions are also less evident under masks [42].

A decrease in empathy perception through mask use with disruption of the doctor–patient relationship has already been scientifically proven on the basis of a randomized study (statistically significant, with $p = 0.04$) [99]. In this study, the Consultation Empathy Care Measury, the Patient Enablement Instrument (PEI) Score and a Satisfaction Rating Scale were assessed in 1030 patients. The 516 doctors, who wore masks throughout, conveyed reduced empathy towards the patients and, thus, nullified the positive health-promoting effects of a dynamic relationship. These results demonstrate a disruption of interpersonal interaction and relationship dynamics caused by masks.

The WHO guidance on the use of masks in children in the community, published in August 2020, points out that the benefits of mask use in children must be weighed up against the potential harms, including social and communicational concerns [100].

Fears that widespread pandemic measures will lead to dysfunctional social life with degraded social, cultural and psychological interactions have also been expressed by other experts [6–8,42].

3.11. Social and Occupational Medicine Side Effects and Hazards

In addition to mask-specific complaints such as a feeling of heat, dampness, shortness of breath and headache, various physiological phenomena were documented, such as the significant increase in heart and respiratory rate, the impairment of lung function parameters, the decrease in cardiopulmonary capacity (e.g., lower maximum blood lactate response) [15,19,21,23,29–31], as well as the changes in oxygen and carbon dioxide both in the end-expiratory and the air under the mask that was measured in the blood of the individuals [13,15,18,19,21–25,27–34]. The significant changes were measurable after only a few minutes of wearing a mask and in some cases reached magnitudes of minus 13% reduced O_2 concentration and 30-fold increased CO_2 concentration of the inhaled air under masks ($p < 0.001$) [18]. The changes observed were not only statistically significant, but also clinically relevant; the subjects also showed pathological oxygen saturation after exposure to masks ($p < 0.02$) [18].

Shortness of breath during light exertion (6 min walking) under surgical masks has been recorded with statistical significance in 44 healthy subjects in a prospective experimental intervention study ($p < 0.001$) [101]. Here, the complaints were assessed using a subjective, visual analogue scale.

In another study from 2011, all tested masks caused a significantly measurable increase in discomfort and a feeling of exhaustion in the 27 subjects during prolonged usage ($p < 0.0001$) [69].

These symptoms lead to additional stress for the occupational mask wearer and, thus, in relation to the feeling of exhaustion, contribute to the self-perpetuating vicious circle caused by the vegetative sympathetic activation, which further increases the respiratory and heart rate, blood pressure and increased sense of exhaustion [16,20,35,83].

Other studies showed that the psychological and physical effects of the masks can lead to an additional reduction in work performance (measured with the Roberge Subjective Symptoms-during-Work Scale, a Likert scale of 1–5) via increased feelings of fatigue, dissatisfaction and anxiety [58,102,103].

Wearing masks over a longer period of time also led to physiological and psychological impairments in other studies and, thus, reduced work performance [19,36,58,69]. In experiments on respiratory-protective equipment, an increase in the dead space volume by 350 mL leads to a reduction in the possible performance time by approx. −19%, furthermore to a decrease in breathing comfort by −18% (measured via a subjective rating scale) [58]. In addition, the time spent working and the flow of work is interrupted and reduced by putting on and taking off the masks and changing them. The reduced work performance has been recorded in the literature found as described above (especially in Sections 3.1 and 3.2) but has not been quantified further in detail [36,58].

Surgical mask type and N95 protective equipment frequently caused adverse effects in medical personnel such as headaches, breathing difficulties, acne, skin irritation, itching, decreased alertness, decreased mental performance and feelings of dampness and heat [19,29,37,71,85]. Subjective, work performance-reducing, mask-related impairments in users, measured with special survey scores and Likert scales, have also been described in other studies [15,21,27,32,35,43,66–68,72,96,99].

In Section 3.7 on dermatology, we already mentioned a paper that demonstrated a significant temperature increase of 1.9 °C on average (to over 34.5 °C) in the mask-covered facial area ($p < 0.05$) [85]. Due to the relatively larger representation in the sensitive cerebral cortex (homunculus), the temperature sensation in the face is more decisive for the feeling of well-being than other body regions [36,44]. The perception of discomfort when wearing a mask can, thus, be intensified. Interestingly, in our analysis, we found a combined occurrence of the physical variable temperature rise under the mask and the symptom respiratory impairment in seven of eight studies concerned, with a mutual significantly measured occurrence in 88%. We also detected a combined occurrence of significantly measured temperature rise under the mask and significantly measured fatigue in 50% of the relevant primary studies (three of six papers, Figure 2). These clustered associations of

temperature rise with symptoms of respiratory impairment and fatigue suggest a clinical relevance of the detected temperature rise under masks. In the worst case scenario, the effects mentioned can reinforce each other and lead to decompensation, especially in the presence of COPD, heart failure and respiratory insufficiency.

The sum of the disturbances and discomforts that can be caused by a mask also contributes to distraction (see also psychological impairment). These, in conjunction with a decrease in psycho-motoric skills, reduced responsiveness and overall impaired cognitive performance (all of which are pathophysiological effects of wearing a mask) [19,29,32,39–41] can lead to a failure to recognize hazards and, thus, to accidents or avoidable errors at work [19,36,37]. Of particular note here are mask-induced listlessness ($p < 0.05$), impaired thinking ($p < 0.05$) and concentration problems ($p < 0.02$) as measured by a Likert scale (1–5) [29]. Accordingly, occupational health regulations take action against such scenarios. The German Industrial Accident Insurance (DGUV) has precise and extensive regulations for respiratory protective equipment where they document the limitation of wearing time, levels of work intensity and defined instruction obligation [104].

The standards and norms prescribed in many countries regarding different types of masks to protect their workers are also significant from an occupational health point of view [105]. In Germany, for example, there are very strict safety specifications for masks from other international countries. These specify the requirements for the protection of the wearer [106]. All these standards and the accompanying certification procedures were increasingly relaxed with the introduction of mandatory masks for the general public. This meant that non-certified masks such as community masks were also used on a large scale in the work and school sectors for longer periods during the pandemic measures [107]. Most recently, in October 2020, the German Social Accident Insurance (DGUV) recommended the same usage time limits for community masks as for filtering half masks, namely, a maximum of three shifts of 120 min per day with recovery breaks of 30 min in between. In Germany, FFP2 (N95) masks must be worn for 75 min, followed by a 30-minute break. An additional suitability examination by specialized physicians is also obligatory and stipulated for occupationally used respirators [104].

3.12. *Microbiological Consequences for Wearer and Environment: Foreign/Self-Contamination*

Masks cause retention of moisture [61]. Poor filtration performance and incorrect use of surgical masks and community masks, as well as their frequent reuse, imply an increased risk of infection [108–110]. The warm and humid environment created by and in masks without the presence of protective mechanisms such as antibodies, the complement system, defense cells and pathogen-inhibiting and on a mucous membrane paves the way for unimpeded growth and, thus, an ideal growth and breeding ground for various pathogens such as bacteria and fungi [88] and also allows viruses to accumulate [87]. The warm and humid mask microclimate favors the accumulation of various germs on and underneath the masks [86], and the germ density is measurably proportional to the length of time the mask is worn. After only 2 h of wearing the mask, the pathogen density increases almost tenfold in experimental observation studies [87,89].

From a microbiological and epidemiological point of view, masks in everyday use pose a risk of contamination. This can occur as foreign contamination but also as self-contamination. On the one hand, germs are sucked in or attach themselves to the masks through convection currents. On the other hand, potential infectious agents from the nasopharynx accumulate excessively on both the outside and inside of the mask during breathing [5,88]. This is compounded by contact with contaminated hands. Since masks are constantly penetrated by germ-containing breath and the pathogen reproduction rate is higher outside mucous membranes, potential infectious pathogens accumulate excessively on the outside and inside of masks. On and in the masks, there are quite serious, potentially disease-causing bacteria and fungi such as *E. coli* (54% of all germs detected), Staphylococcus aureus (25% of all germs detected), Candida (6%), Klebsiella (5%), Enterococci (4%),

Pseudomonads (3%), Enterobacter (2%) and Micrococcus (1%) even detectable in large quantities [88].

In another microbiological study, the bacterium Staphylococcus aureus (57% of all bacteria detected) and the fungus Aspergillus (31% of all fungi detected) were found to be the dominant germs on 230 surgical masks examined [86].

After more than six hours of use, the following viruses were found in descending order on 148 masks worn by medical personnel: adenovirus, bocavirus, respiratory syncytial virus and influenza viruses [87].

From this aspect, it is also problematic that moisture distributes these potential pathogens in the form of tiny droplets via capillary action on and in the mask, whereby further proliferation in the sense of self- and foreign contamination by the aerosols can then occur internally and externally with every breath [35]. In this regard, it is also known from the literature that masks are responsible for a proportionally disproportionate production of fine particles in the environment and, surprisingly, much more so than in people without masks [98].

It was shown that all mask-wearing subjects released significantly more smaller particles of size 0.3–0.5 μm into the air than mask-less people, both when breathing, speaking and coughing (fabric, surgical, N95 masks, measured with the Aerodynamic Particle Sizer, APS, TS, model 3329) [98]. The increase in the detection of rhinoviruses in the sentinel studies of the German RKI from 2020 [90] could be a further indication of this phenomenon, as masks were consistently used by the general population in public spaces in that year.

3.13. Epidemiological Consequences

The possible side effects and dangers of masks described in this paper are based on studies of different types of masks. These include the professional masks of the surgical mask type and N95/KN95 (FFP2 equivalent) that are commonly used in everyday life, but also the community fabric masks that were initially used. In the case of N95, the N stands for National Institute for Occupational Safety and Health of the United States (NIOSH), and 95 indicates the 95 per cent filtering capacity for fine particles up to at least 0.3 μm [82].

A major risk of mask use in the general public is the creation of a false sense of security with regard to protection against viral infections, especially in the sense of a falsely assumed strong self-protection. Disregarding infection risks may not only neglect aspects of source control, but also result in other disadvantages. Although there are quite a few professional positive accounts of the widespread use of masks in the general populace [111], most of the serious and evident scientific reports conclude that the general obligation to wear masks conveys a false sense of security [4,5]. However, this leads to a neglect of those measures that, according to the WHO, have a higher level of effectiveness than mask-wearing: social distancing and hand hygiene [2,112]. Researchers were able to provide statistically significant evidence of a false sense of security and more risky behavior when wearing masks in an experimental setting [112].

Decision makers in many countries informed their citizens early on in the pandemic in March 2020 that people without symptoms should not use a medical mask, as this created a false sense of security [113]. The recommendation was ultimately changed in many countries. At least Germany pointed out that wearers of certain types of masks such as the common fabric masks (community masks) cannot rely on them to protect them or others from transmission of SARS-CoV-2 [114].

However, scientists not only complain about the lack of evidence for fabric masks in the scope of a pandemic [16,110], but also about the high permeability of fabric masks with particles and the potential risk of infection they pose [108,109]. Ordinary fabric masks with a 97% penetration for particle dimensions of ≥0.3 μm are in stark contrast to medical-type surgical masks with a 44% penetration. In contrast, the N95 mask has a penetration rate of less than 0.01% for particles ≥ 0.3 μm in the laboratory experiment [108,115].

For the clinical setting in hospitals and outpatient clinics, the WHO guidelines recommend only surgical masks for influenza viruses for the entire patient treatment except for the strongly aerosol-generating measures, for which finer filtering masks of the type N95 are suggested. However, the WHO's endorsement of specific mask types is not entirely evidence-based due to the lack of high-quality studies in the health sector [108,109,116,117].

In a laboratory experiment (evidence level IIa study), it was demonstrated that both surgical masks and N95 masks have deficits in protection against SARS-CoV-2 and influenza viruses using virus-free aerosols [118]. In this study, the FFP2-equivalent N95 mask performed significantly better in protection (8–12 times more effective) than the surgical mask, but neither mask type established reliable, hypothesis-generated protection against corona and influenza viruses. Both mask types could be penetrated unhindered by aerosol particles with a diameter of 0.08 to 0.2 μm. Both the SARS-CoV-2 pathogens with a size of 0.06 to 0.14 μm [119] and the influenza viruses with 0.08 to 0.12 μm are unfortunately well below the mask pore sizes [118].

The filtering capacity of the N95 mask up to 0.3 μm [82] is usually not achieved by surgical masks and community masks. However, aerosol droplets, which have a diameter of 0.09 to 3 μm in size, are supposed to serve as a transport medium for viruses. These also penetrate the medical masks by 40%. Often, there is also a poor fit between the face and the mask, which further impairs their function and safety [120]. The accumulation of aerosol droplets on the mask is problematic. Not only do they absorb nanoparticles such as viruses [6], but they also follow the airflow when inhaling and exhaling, causing them to be carried further. In addition, a physical decay process has been described for aerosol droplets at increasing temperatures, as also occurs under a mask [15,44,85]. This process can lead to a decrease in size of the fine water droplets up to the diameter of a virus [121,122]. The masks filter larger aerosol droplets but cannot retain viruses themselves and such smaller, potentially virus-containing aerosol droplets of less than 0.2 μm and hence cannot stop the spread of virus [123].

Similarly, in an in vivo comparative studies of N95 and surgical masks, there were no significant differences in influenza virus infection rates [124,125]. Although this contrasts with encouraging in vitro laboratory results with virus-free aerosols under non-natural conditions, even with fabric masks [126], it should be noted that under natural in-vivo conditions, the promising filtration functions of fabric masks based on electrostatic effects also rapidly diminish under increasing humidity [127]. A Swiss textile lab test of various masks available on the market to the general public recently confirmed that most mask types filter aerosols insufficiently. For all but one of the eight reusable fabric mask types tested, the filtration efficacy according to EN149 was always less than 70% for particles of 1 μm in size. For disposable masks, only half of all eight mask types tested were efficient enough at filtering to retain 70% of particles 1 μm in size [128].

A recent experimental study even demonstrated that all mask-wearing people (surgical, N95, fabric masks) release significantly and proportionately smaller particles of size 0.3 to 0.5 μm into the air than mask-less people, both when breathing, speaking and coughing [98]. According to this, the masks act like nebulizers and contribute to the production of very fine aerosols. Smaller particles, however, spread faster and further than large ones for physical reasons. Of particular interest in this experimental reference study was the finding that a test subject wearing a single-layer fabric mask was also able to release a total of 384% more particles (of various sizes) when breathing than a person without [98].

It is not only the aforementioned functional weaknesses of the masks themselves that lead to problems, but also their use. This increases the risk of a false sense of security. According to the literature, mistakes are made by both healthcare workers and lay people when using masks as hygienically correct mask use is by no means intuitive. Overall, 65% of healthcare professionals and as many as 78% of the general population, use masks incorrectly [116]. With both surgical masks and N95 masks, adherence to the rules of use is impaired and not adequately followed due to reduced wearability with heat discomfort and skin irritation [29,35,116,129]. This is exacerbated by the accumulation of carbon dioxide

due to the dead space (especially under the N95 masks) with the resulting headaches described [19,27,37,66–68,83]. Increased heart rate, itching and feelings of dampness [15,29,30,35,71] also lead to reduced safety and quality during use (see also social and occupational health side effects and hazards). For this reason, (everyday) masks are even considered a general risk for infection in the general population, which does not come close to imitating the strict hygiene rules of hospitals and doctors' offices: the supposed safety, thus, becomes a safety risk itself [5].

In a meta-analysis of evidence level Ia commissioned by the WHO, no effect of masks in the context of influenza virus pandemic prevention could be demonstrated [130]. In 14 randomized controlled trials, no reduction in the transmission of laboratory-confirmed influenza infections was shown. Due to the similar size and distribution pathways of the virus species (influenza and Corona, see above), the data can also be transferred to SARS-CoV-2 [118]. Nevertheless, a combination of occasional mask-wearing with adequate hand-washing caused a slight reduction in infections for influenza in one study [131]. However, since no separation of hand hygiene and masks was achieved in this study, the protective effect can rather be attributed to hand hygiene in view of the aforementioned data [131].

A recently published large prospective Danish comparative study comparing mask wearers and non-mask wearers in terms of their infection rates with SARS-CoV2 could not demonstrate any statistically significant differences between the groups [132].

3.14. Paediatric Side Effects and Hazards

Children are particularly vulnerable and may be more likely to receive inappropriate treatment or additional harm. It can be assumed that the potential adverse mask effects described for adults are all the more valid for children (see Section 3.1 to Section 3.13: physiological internal, neurological, psychological, psychiatric, dermatological, ENT, dental, sociological, occupational and social medical, microbiological and epidemiological impairments and also Figures 2 and 3).

Special attention must be paid to the respiration of children, which represents a critical and vulnerable physiological variable due to higher oxygen demand, increased hypoxia susceptibility of the CNS, lower respiratory reserve, smaller airways with a stronger increase in resistance when the lumen is narrowed. The diving reflex caused by stimulating the nose and upper lip can cause respiratory arrest to bradycardia in the event of oxygen deficiency.

The masks currently used for children are exclusively adult masks manufactured in smaller geometric dimensions and had neither been specially tested nor approved for this purpose [133].

In an experimental British research study, the masks frequently led to feelings of heat ($p < 0.0001$) and breathing problems ($p < 0.03$) in 100 school children between 8 and 11 years of age especially during physical exertion, which is why the protective equipment was taken off by 24% of the children during physical activity [133]. The exclusion criteria for this mask experiment were lung disease, cardiovascular impairment and claustrophobia [133].

Scientists from Singapore were able to demonstrate in their level Ib study published in the renowned journal "nature" that 106 children aged between 7 and 14 years who wore FFP2 masks for only 5 min showed an increase in the inspiratory and expiratory CO_2 levels, indicating disturbed respiratory physiology [26].

However, a disturbed respiratory physiology in children can have long-term disease-relevant consequences. Slightly elevated CO_2 levels are known to increase heart rate, blood pressure, headache, fatigue and concentration disorders [38].

Accordingly, the following conditions were listed as exclusion criteria for mask use [26]: any cardiopulmonary disease including but not limited to: asthma, bronchitis, cystic fibrosis, congenital heart disease, emphysema; any condition that may be aggravated by physical exertion, including but not limited to: exercise-induced asthma; lower respiratory tract infections (pneumonia, bronchitis within the last 2 weeks), anxiety disorders,

diabetes, hypertension or epilepsy/attack disorder; any physical disability due to medical, orthopedic or neuromuscular disease; any acute upper respiratory illness or symptomatic rhinitis (nasal obstruction, runny nose or sneezing); any condition with deformity that affects the fit of the mask (e.g., increased facial hair, craniofacial deformities, etc.).

It is also important to emphasize the possible effects of masks in neurological diseases, as described earlier (Section 3.3).

Both masks and face shields caused fear in 46% of children (37 out of 80) in a scientific study. If children are given the choice of whether the doctor examining them should wear a mask they reject this in 49% of the cases. Along with their parents, the children prefer the practitioner to wear a face visor (statistically significant with $p < 0.0001$) [134].

A recent observational study of tens of thousands of mask-wearing children in Germany helped the investigators objectify complaints of headaches (53%), difficulty concentrating (50%), joylessness (49%), learning difficulties (38%) and fatigue in 37% of the 25,930 children evaluated. Of the children observed, 25% had new onset anxiety and even nightmares [135]. In children, the threat scenarios generated by the environment are further maintained via masks, in some cases, even further intensified, and in this way, existing stress is intensified (presence of subconscious fears) [16,35,136,137].

This can in turn lead to an increase in psychosomatic and stress-related illnesses [74,75]. For example, according to an evaluation, 60% of mask wearers showed stress levels of the highest grade 10 on a scale of 1 to a maximum of 10. Less than 10% of the mask wearers surveyed had a stress level lower than 8 out of a possible 10 [74].

As children are considered a special group, the WHO also issued a separate guideline on the use of masks in children in the community in August 2020, explicitly advising policy makers and national authorities, given the limited evidence, that the benefits of mask use in children must be weighed up against the potential harms associated with mask use. This includes feasibility and discomfort, as well as social and communication concerns [100].

According to experts, masks block the foundation of human communication and the exchange of emotions and not only hinder learning but deprive children of the positive effects of smiling, laughing and emotional mimicry [42]. The effectiveness of masks in children as a viral protection is controversial, and there is a lack of evidence for their widespread use in children; this is also addressed in more detail by the scientists of the German University of Bremen in their thesis paper 2.0 and 3.0 [138].

3.15. *Effects on the Environment*

According to WHO estimates of a demand of 89 million masks per month, their global production will continue to increase under the Corona pandemic [139]. Due to the composition of, e.g., disposable surgical masks with polymers such as polypropylene, polyurethane, polyacrylonitrile, polystyrene, polycarbonate, polyethylene and polyester [140], an increasing global challenge, also from an environmental point of view, can be expected, especially outside Europe, in the absence of recycling and disposal strategies [139]. The aforementioned single use polymers have been identified as a significant source of plastic and plastic particles for the pollution of all water cycles up to the marine environment [141].

A significant health hazard factor is contributed by mask waste in the form of microplastics after decomposition into the food chain. Likewise, contaminated macroscopic disposable mask waste—especially before microscopic decay—represents a widespread medium for microbes (protozoa, bacteria, viruses, fungi) in terms of invasive pathogens [86–89,142]. Proper disposal of bio-contaminated everyday mask material is insufficiently regulated even in western countries.

4. Discussion

The potential drastic and undesirable effects found in multidisciplinary areas illustrate the general scope of global decisions on masks in general public in the light of combating the pandemic. According to the literature found, there are clear, scientifically recorded adverse effects for the mask wearer, both on a psychological and on a social and physical level.

Neither higher level institutions such as the WHO or the European Centre for Disease Prevention and Control (ECDC) nor national ones, such as the Centers for Disease Control and Prevention, GA, USA (CDC) or the German RKI, substantiate with sound scientific data a positive effect of masks in the public (in terms of a reduced rate of spread of COVID-19 in the population) [2,4,5].

Contrary to the scientifically established standard of evidence-based medicine, national and international health authorities have issued their theoretical assessments on the masks in public places, even though the compulsory wearing of masks gives a deceptive feeling of safety [5,112,143].

From an infection epidemiological point of view, masks in everyday use offer the risk of self-contamination by the wearer from both inside and outside, including via contaminated hands [5,16,88]. In addition, masks are soaked by exhaled air, which potentially accumulates infectious agents from the nasopharynx and also from the ambient air on the outside and inside of the mask. In particular, serious infection-causing bacteria and fungi should be mentioned here [86,88,89], but also viruses [87]. The unusual increase in the detection of rhinoviruses in the sentinel studies of the German RKI from 2020 [90] could be an indication of this phenomenon. Clarification through further investigations would therefore be desirable.

Masks, when used by the general public, are considered by scientists to pose a risk of infection because the standardized hygiene rules of hospitals cannot be followed by the general public [5]. On top of that, mask wearers (surgical, N95, fabric masks) exhale relatively smaller particles (size 0.3 to 0.5 μm) than mask-less people and the louder speech under masks further amplifies this increased fine aerosol production by the mask wearer (nebulizer effect) [98].

The history of modern times shows that already in the influenza pandemics of 1918–1919, 1957–58, 1968, 2002, in SARS 2004–2005 as well as with the influenza in 2009, masks in everyday use could not achieve the hoped-for success in the fight against viral infection scenarios [67,144]. The experiences led to scientific studies describing as early as 2009 that masks do not show any significant effect with regard to viruses in an everyday scenario [129,145]. Even later, scientists and institutions rated the masks as unsuitable to protect the user safely from viral respiratory infections [137,146,147]. Even in hospital use, surgical masks lack strong evidence of protection against viruses [67].

Originally born out of the useful knowledge of protecting wounds from surgeons' breath and predominantly bacterial droplet contamination [144,148,149], the mask has been visibly misused with largely incorrect popular everyday use, particularly in Asia in recent years [150]. Significantly, the sociologist Beck described the mask as a cosmetic of risk as early as 1992 [151]. Unfortunately, the mask is inherent in a vicious circle: strictly speaking, it only protects symbolically and at the same time represents the fear of infection. This phenomenon is reinforced by the collective fear mongering, which is constantly nurtured by main stream media [137].

Nowadays, the mask represents a kind of psychological support for the general population during the virus pandemic, promising them additional anxiety-reduced freedom of movement. The recommendation to use masks in the sense of "source control" not out of self-protection but out of "altruism" [152] is also very popular with the regulators as well as the population of many countries. The WHO's recommendation of the mask in the current pandemic is not only a purely infectiological approach, but is also clear on the possible advantages for healthy people in the general public. In particular, a reduced potential stigmatization of mask wearers, the feeling of a contribution made to preventing the spread of the virus, as well as the reminder to adhere to other measures are mentioned [2].

It should not go unmentioned that very recent data suggest that the detection of SARS-CoV-2 infection does not seem to be directly related to popular mask use. The groups examined in a retrospective comparative study (infected with SARS-CoV-2 and not infected) did not differ in their habit of using masks: approximately 70% of the subjects in both groups always wore masks and another 14.4% of them frequently [143].

In a Danish prospective study on mask-wearing carried out on about 6000 participants and published in 2020, scientists found no statistically significant difference in the rates of SARS-CoV-2 infection when comparing the group of 3030 mask wearers with the 2994 maskless participants in the study ($p = 0.38$) [132].

Indeed, in the case of viral infections, masks appear to be not only less effective than expected, but also not free of undesirable biological, chemical, physical and psychological side effects [67]. Accordingly, some experts claim that well-intentioned unprofessionalism can be quite dangerous [6].

The dermatological colleagues were the first to describe common adverse effects of mask-wearing in larger collectives. Simple, direct physical, chemical and biological effects of the masks with increases in temperature, humidity and mechanical irritation caused acne in up to 60% of wearers [37,71–73,85]. Other significantly documented consequences were eczema, skin damage and overall impaired skin barrier function [37,72,73].

These direct effects of mask use are an important pointer to further detrimental effects affecting other organ systems.

In our work, we have identified scientifically validated and numerous statistically significant adverse effects of masks in various fields of medicine, especially with regard to a disruptive influence on the highly complex process of breathing and negative effects on the respiratory physiology and gas metabolism of the body (see Figures 2 and 3). The respiratory physiology and gas exchange play a key role in maintaining a health-sustaining balance in the human body [136,153]. According to the studies we found, a dead space volume that is almost doubled by wearing a mask and a more than doubled breathing resistance (Figure 3) [59–61] lead to a rebreathing of carbon dioxide with every breathing cycle [16–18,39,83] with—in healthy people mostly—a subthreshold but, in sick people, a partly pathological increase in the carbon dioxide partial pressure ($PaCO_2$) in the blood [25,34,58]. According to the primary studies found, these changes contribute reflexively to an increase in respiratory frequency and depth [21,23,34,36] with a corresponding increase in the work of the respiratory muscles via physiological feedback mechanisms [31,36]. Thus, it is not, as initially assumed, purely positive training through mask use. This often increases the subliminal drop in oxygen saturation SpO_2 in the blood [23,28–30,32], which is already reduced by increased dead space volume and increased breathing resistance [18,31].

The overall possible resulting measurable drop in oxygen saturation O_2 of the blood on the one hand [18,23,28–30,32] and the increase in carbon dioxide (CO_2) on the other [13,15,19,21–28] contribute to an increased noradrenergic stress response, with heart rate increase [29,30,35] and respiratory rate increase [15,21,23,34], in some cases also to a significant blood pressure increase [25,35].

In panic-prone individuals, stress-inducing noradrenergic sympathetic activation can be partly directly mediated via the carbon dioxide (CO_2) mechanism at the locus coeruleus in the brainstem [39,78,79,153], but also in the usual way via chemo-sensitive neurons of the nucleus solitarius in the medulla [136,154]. The nucleus solitarius [136] is located in the deepest part of the brainstem, a gateway to neuronal respiratory and circulatory control [154]. A decreased oxygen (O_2) blood level there causes the activation of the sympathetic axis via chemoreceptors in the carotids [155,156].

Even subthreshold changes in blood gases such as those provoked when wearing a mask cause reactions in these control centers in the central nervous system. Masks, therefore, trigger direct reactions in important control centers of the affected brain via the slightest changes in oxygen and carbon dioxide in the blood of the wearer [136,154,155].

A link between disturbed breathing and cardiorespiratory diseases such as hypertension, sleep apnea and metabolic syndrome has been scientifically proven [56,57]. Interestingly, decreased oxygen/O_2 blood levels and also increased carbon dioxide/CO_2 blood levels are considered the main triggers for the sympathetic stress response [38,136]. The aforementioned chemo-sensitive neurons of the nucleus solitarius in the medulla are considered to be the main responsible control centers [136,154,155]. Clinical effects of prolonged mask-wearing would, thus, be a conceivable intensification of chronic stress re-

actions and negative influences on the metabolism leading towards a metabolic syndrome. The mask studies we found show that such disease-relevant respiratory gas changes (O_2 and CO_2) [38,136] are already achieved by wearing a mask [13,15,18,19,21–34].

A connection between hypoxia, sympathetic reactions and leptin release is scientifically known [136].

Additionally important is the connection of breathing with the influence on other bodily functions [56,57], including the psyche with the generation of positive emotions and drive [153]. The latest findings from neuro-psychobiological research indicate that respiration is not only a function regulated by physical variables to control them (feedback mechanism), but rather independently influences higher-level brain centers and, thus, also helps to shape psychological and other bodily functions and reactions [153,157,158]. Since masks impede the wearer's breathing and accelerate it, they work completely against the principles of health-promoting breathing [56,57] used in holistic medicine and yoga. According to recent research, undisturbed breathing is essential for happiness and healthy drive [157,159], but masks work against this.

The result of significant changes in blood gases in the direction of hypoxia (drop in oxygen saturation) and hypercapnia (increase in carbon dioxide concentration) through masks, thus, has the potential to have a clinically relevant influence on the human organism even without exceeding normal limits.

According to the latest scientific findings, blood-gas shifts towards hypoxia and hypercapnia not only have an influence on the described immediate, psychological and physiological reactions on a macroscopic and microscopic level, but additionally on gene expression and metabolism on a molecular cellular level in many different body cells. Through this, the drastic disruptive intervention of masks in the physiology of the body also becomes clear down to the cellular level, e.g., in the activation of hypoxia-induced factor (HIF) through both hypercapnia and hypoxia-like effects [160]. HIF is a transcription factor that regulates cellular oxygen supply and activates signaling pathways relevant to adaptive responses. e.g., HIF inhibits stem cells, promotes tumor cell growth and inflammatory processes [160]. Based on the hypoxia- and hypercapnia-promoting effects of masks, which have been comprehensively described for the first time in our study, potential disruptive influences down to the intracellular level (HIF-a) can be assumed, especially through the prolonged and excessive use of masks. Thus, in addition to the vegetative chronic stress reaction in mask wearers, which is channeled via brain centers, there is also likely to be an adverse influence on metabolism at the cellular level. With the prospect of continued mask use in everyday life, this also opens up an interesting field of research for the future.

The fact that prolonged exposure to latently elevated CO_2 levels and unfavorable breathing air compositions has disease-promoting effects was recognized early on. As early as 1983, the WHO described "Sick Building Syndrome" (SBS) as a condition in which people living indoors experienced acute disease-relevant effects that increased with time of their stay, without specific causes or diseases [161,162]. The syndrome affects people who spend most of their time indoors, often with subliminally elevated CO_2 levels, and are prone to symptoms such as increased heart rate, rise in blood pressure, headaches, fatigue and difficulty concentrating [38,162]. Some of the complaints described in the mask studies we found (Figure 2) are surprisingly similar to those of Sick Building Syndrome [161]. Temperature, carbon dioxide content of the air, headaches, dizziness, drowsiness and itching also play a role in Sick Building Syndrome. On the one hand, masks could themselves be responsible for effects such as those described for Sick Building Syndrome when used for a longer period of time. On the other hand, they could additionally intensify these effects when worn in air-conditioned buildings, especially when masks are mandatory indoors. Nevertheless, there was a tendency towards higher systolic blood pressure values in mask wearers in some studies [21,31,34], but statistical significance was only found in two studies [25,35]. However, we found more relevant and significant evidence of heart

rate increase, headache, fatigue and concentration problems associated with mask wearers (Figure 2) indicating the clinical relevance of wearing masks.

According to the scientific results and findings, masks have measurably harmful effects not only on healthy people, but also on sick people and their relevance is likely to increase with the duration of use [69]. Further research is needed here to shed light on the long-term consequences of widespread mask use with subthreshold hypoxia and hypercapnia in the general population, also regarding possible exacerbating effects on cardiorespiratory lifestyle diseases such as hypertension, sleep apnea and metabolic syndrome. The already often elevated blood carbon dioxide (CO_2) levels in overweight people, sleep apnea patients and patients with overlap-COPD could possibly increase even further with everyday masks. Not only a high body mass index (BMI) but also sleep apnea are associated with hypercapnia during the day in these patients (even without masks) [19,163]. For such patients, hypercapnia means an increase in the risk of serious diseases with increased morbidity, which could then be further increased by excessive mask use [18,38].

The hypercapnia-induced effects of sympathetic stress activation are even cycle phase-dependent in women. Controlled by a progesterone mechanism, the sympathetic reaction, measured by increased blood pressure in the luteal phase, is considerably stronger [164]. This may also result in different sensitivities for healthy and sick women to undesirable effects masks have, which are related to an increase in carbon dioxide (CO_2).

In our review, negative physical and psychological changes caused by masks could be objectified even in younger and healthy individuals.

The physical and chemical parameters did not exceed the normal values in most cases but were statistically significantly measurable ($p < 0.05$) tending towards pathological ranges. They were accompanied by physical impairments (see Figure 2). It is well known that subthreshold stimuli are capable of causing pathological changes when exposed to them for a long time: not only a single high dose of a disturbance, but also a chronically persistent, subthreshold exposure to it often leads to illness [38,46–48,50–54]. The scientifically repeatedly measurable physical and chemical mask effects were often accompanied by typical subjective complaints and pathophysiological phenomena. The fact that these frequently occur simultaneously and together indicates a syndrome under masks.

Figure 2 sums up the significant mask-dependent physiological, psychological, somatic and general pathological changes and their frequent occurrence together is striking. Within the framework of the quantitative evaluation of the experimental studies, we were actually able to prove a statistically significant correlation of the observed side effects of fatigue and oxygen depletion under mask use with $p < 0.05$. In addition, we found a frequent, simultaneous and joint occurrence of further undesirable effects in the scientific studies (Figure 2). Statistically significant associations of such co-occurring, adverse effects have already been described in primary studies [21,29]. We detected a combined occurrence of the physical parameter temperature rise under the mask with the symptom respiratory impairment in seven of the nine studies concerned (88%). We found a similar result for the decrease in oxygen saturation under mask and the symptom respiratory impairment with a simultaneous detection in six of the eight studies concerned (67%). We detected a combined occurrence of carbon dioxide rise under N95 mask use in nine of the 11 scientific papers (82%). We found a similar result for oxygen drop under N95 mask use with simultaneous co-occurrence in eight of 11 primary papers (72%). The use of N95 masks was also associated with headache in six of the 10 primary studies concerned (60%). A combined occurrence of the physical parameters temperature rise and humidity under masks was even found 100% within six of the six studies with significant measurements of these parameters (Figure 2).

Since the symptoms were described in combination in mask wearers and were not observed in isolation in the majority of cases, we refer to them as general Mask-Induced Exhaustion Syndrome (MIES) because of the consistent presentation in numerous papers from different disciplines. These include the following, predominantly statistically significantly

($p < 0.05$) proven pathophysiological changes and subjective complaints, which often occur in combination as described above (see also Section 3.1 to Section 3.11, Figures 2–4):

- Increase in dead space volume [22,24,58,59] (Figure 3, Sections 3.1 and 3.2).
- Increase in breathing resistance [31,35,61,118] (Figure 3, Figure 2: Column 8).
- Increase in blood carbon dioxide [13,15,19,21–28] (Figure 2: Column 5).
- Decrease in blood oxygen saturation [18,19,21,23,28–34] (Figure 2: Column 4).
- Increase in heart rate [15,19,23,29,30,35] (Figure 2: Column 12).
- Decrease in cardiopulmonary capacity [31] (Section 3.2).
- Feeling of exhaustion [15,19,21,29,31–35,69] (Figure 2: Column 14).
- Increase in respiratory rate [15,21,23,34] (Figure 2: Column 9).
- Difficulty breathing and shortness of breath [15,19,21,23,25,29,31,34,35,71,85,101,133] (Figure 2: Column 13).
- Headache [19,27,37,66–68,83] (Figure 2: Column 17).
- Dizziness [23,29] (Figure 2: Column 16).
- Feeling of dampness and heat [15,16,22,29,31,35,85,133] (Figure 2: Column 7).
- Drowsiness (qualitative neurological deficits) [19,29,32,36,37] (Figure 2: Column 15).
- Decrease in empathy perception [99] (Figure 2: Column 19).
- Impaired skin barrier function with acne, itching and skin lesions [37,72,73] (Figure 2: Column 20–22).

It can be deduced from the results that the effects described in healthy people are all more pronounced in sick people, since their compensatory mechanisms, depending on the severity of the illness, are reduced or even exhausted. Some existing studies on and with patients with measurable pathological effects of the masks support this assumption [19,23,25,34]. In most scientific studies, the exposure time to masks in the context of the measurements/investigations was significantly less (in relation to the total wearing and duration of use) than is expected of the general public under the current pandemic regulations and ordinances.

The exposure time limits are little observed or knowingly disregarded in many areas today as already mentioned in Section 3.11 on occupational medicine. The above facts allow the conclusion that the described negative effects of masks, especially in some of our patients and the very elderly, may well be more severe and adverse with prolonged use than presented in some mask studies.

From a doctor's viewpoint, it may also be difficult to advise children and adults who, due to social pressure (to wear a mask) and the desire to feel they belong, suppress their own needs and concerns until the effects of masks have a noticeable negative impact on their health [76]. Nevertheless, the use of masks should be stopped immediately at the latest when shortness of breath, dizziness or vertigo occur [23,25]. From this aspect, it seems sensible for decision makers and authorities to provide information, to define instruction obligations and offer appropriate training for employers, teachers and other persons who have a supervisory or caregiving duty. Knowledge about first aid measures could also be refreshed and expanded accordingly in this regard.

Elderly, high-risk patients with lung disease, cardiac patients, pregnant women or stroke patients are advised to consult a physician to discuss the safety of an N95 mask as their lung volume or cardiopulmonary performance may be reduced [23]. A correlation between age and the occurrence of the aforementioned symptoms while wearing a mask has been statistically proven [19]. Patients with reduced cardiopulmonary function are at increased risk of developing serious respiratory failure with mask use according to the referenced literature [34]. Without the possibility of continuous medical monitoring, it can be concluded that they should not wear masks without close monitoring. The American Asthma and Allergy Society has already advised caution in the use of masks with regard to the COVID-19 pandemic for people with moderate and severe lung disease [165]. Since the severely overweight, sleep apnea patients and overlap-COPD sufferers are known to be prone to hypercapnia, they also represent a risk group for serious adverse health effects under extensive mask use [163]. This is because the potential of masks to produce additional

CO_2 retention may not only have a disruptive effect on the blood gases and respiratory physiology of sufferers, but may also lead to further serious adverse health effects in the long term. Interestingly, in an animal experiment an increase in CO_2 with hypercapnia leads to contraction of smooth airway muscles with constriction of bronchi [166]. This effect could explain the observed pulmonary decompensations of patients with lung disease under masks (Section 3.2) [23,34].

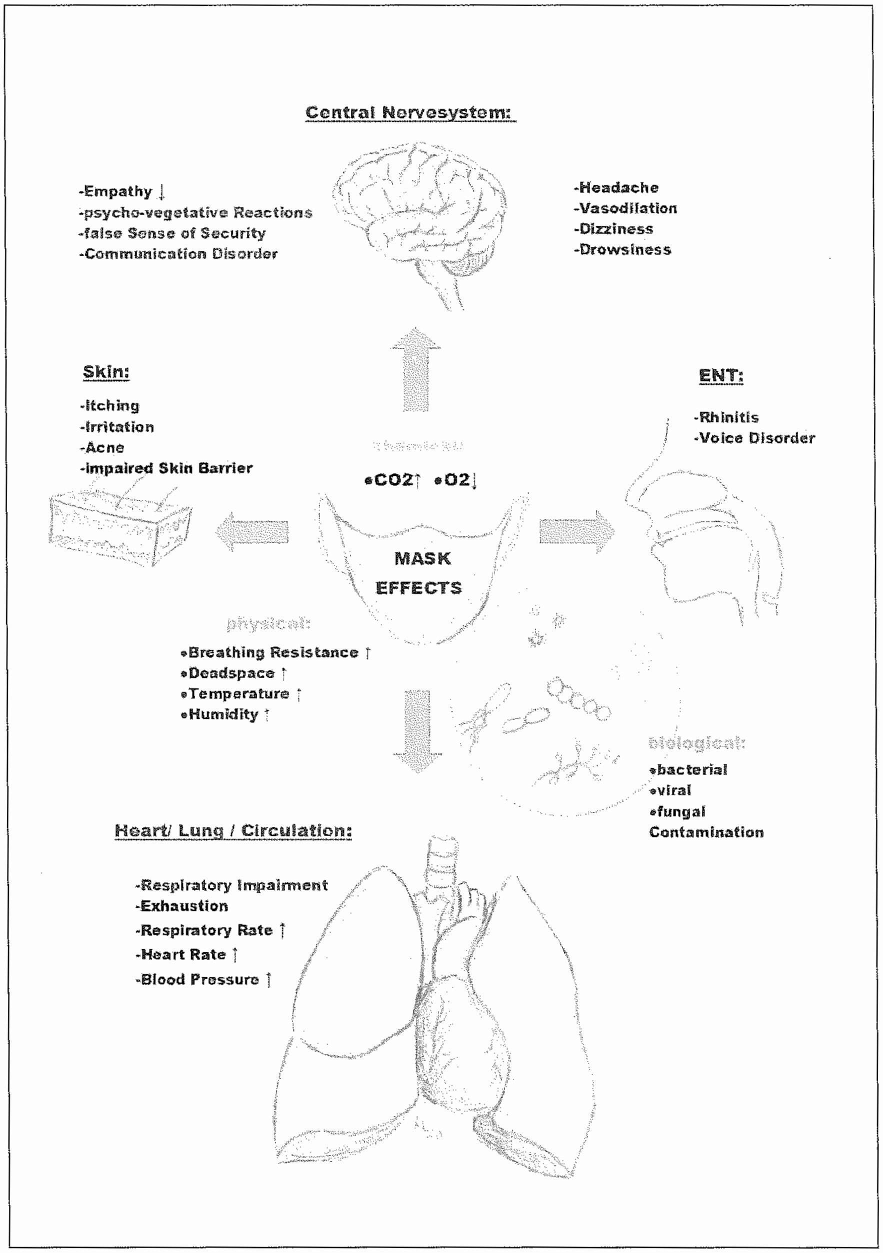

Figure 4. Unfavorable mask effects as components of Mask-Induced Exhaustion Syndrome (MIES). The chemical, physical and biological effects, as well as the organ system consequences mentioned, are all documented with statistically significant results in the scientific literature found (Figure 2). The term drowsiness is used here to summarize any qualitative neurological deficits described in the examined scientific literature.

Patients with renal insufficiency requiring dialysis are, according to the literature available, further candidates for a possible exemption from the mask requirement [34].

According to the criteria of the Centers for Disease Control and Prevention, GA, USA (CDC), sick and helpless people who cannot remove a mask on their own should be exempted from the mask requirement [82].

Since it can be assumed that children react even more sensitively to masks, the literature suggests that masks are a contraindication for children with epilepsies (hyperventilation as a trigger for seizures) [63]. In the field of pediatrics, special attention should also be paid to the mask symptoms described under psychological, psychiatric and sociological effects with possible triggering of panic attacks by CO_2 rebreathing in the case of predisposition and also reinforcement of claustrophobic fears [77–79,167]. The mask-related disturbance of verbal [43,45,71] and non-verbal communication and, thus, of social interaction is particularly serious for children. Masks restrict social interaction and block positive perceptions (smiling and laughing) and emotional mimicry [42]. The proven mask-induced mild to moderate cognitive impairment with impaired thinking, decreased attention and dizziness [19,23,29,32,36,37,39–41,69], as well as the psychological and neurological effects [135], should be additionally taken into account when masks are compulsory at school and in the vicinity of both public and non-public transport, also regarding the possibility of an increased risk of accidents (see also occupational health side effects and hazards) [19,29,32,36,37]. The exclusion criteria mentioned in pediatric studies on masks (see pediatric impairments, Section 3.14) [26,133] should also apply to an exclusion of these children from the general mask obligation in accordance with the scientific findings for the protection of the sick children concerned. The long-term sociological, psychological and educational consequences of a comprehensive masking requirement extended to schools are also unpredictable with regard to the psychological and physical development of healthy children [42,135]. Interestingly, according to the Corona Thesis Paper of the University of Bremen children "are infected less often, they become ill less often, the lethality is close to zero, and they also pass on the infection less often", according to the Thesis Paper 2.0 of the German University of Bremen on page 6 [138]. Studies conducted under real-life conditions with outcome endpoints showing hardly any infections, hardly any morbidity, hardly any mortality and only low contagiousness in children are clearly in the majority, according to Thesis Paper 3.0 of the German University of Bremen [138]. A recent German observational study (5600 reporting pediatricians) also showed a surprisingly low incidence of COVID-19 disease in children [168]. The infection of adults with SARS-CoV-2 by children has been considered in only one suspected case, but could not be proven with certainty, since the parents also had numerous contacts and exposure factors for viral infections due to their occupation. In this case, the circulating headlines in the public media that children contribute more to the incidence of infection are to be regarded as anecdotal.

In pregnant women, the use of masks during exertion or at rest over long periods of time is to be regarded as critical as little research has been done on this [20]. If there is clear scientific evidence of increased dead space ventilation with possible accumulation of CO_2 in the mother's blood, the use of masks by pregnant women for more than 1 h, as well as under physical stress, should be avoided in order to protect the unborn child [20,22]. The hypercapnia-promoting masks could act as a confounder of the fetal/maternal CO_2 gradient in this case (Section 3.6) [20,22,28].

According to the literature cited in the Section 3.5 on psychiatric side effects (personality disorders with anxiety and panic attacks, claustrophobia, dementia and schizophrenia), masking should only be done, if at all, with careful consideration of the advantages and disadvantages. Attention should be paid to possible provocation of the number and severity of panic attacks [77–79].

In patients with headaches, a worsening of symptoms can be expected with prolonged mask use (see also Section 3.3., neurological side effects) [27,66–68]. As a result of the increase in blood carbon dioxide (CO_2) when the mask is used, vasodilatation occurs in the central nervous system and the pulsation of the blood vessels decreases [27]. In this connection, it is also interesting to note radiological experiments that demonstrate an increase in brain volume under subthreshold, but still within normal limits of CO_2 increase

in the blood by means of structural MRI. The blood carbon dioxide increase was produced in seven subjects via rebreathing with resulting median carbon dioxide concentration of 42 mmHg and an interquartile range of 39.44 mmHg, corresponding to only a subthreshold increase given the normal values of 32–45 mmHg. In the experiment, there was a significant increase in brain parenchymal volume measurable under increased arterial CO_2 levels ($p < 0.02$), with a concomitant decrease in CSF spaces ($p < 0.04$), entirely in accordance with the Monroe–Kelly doctrine, according to which the total volume within the skull always remains the same. The authors interpreted the increase in brain volume as an expression of an increase in blood volume due to a CO_2 increase-induced dilation of the cerebral vessels [169]. The consequences of such equally subthreshold carbon dioxide (CO_2) increases even under masks [13,15,18,19,22,23,25] are unclear for people with pathological changes inside the skull (aneurysms, tumors, etc.) with associated vascular changes [27] and brain volume shifts [169] especially due to longer exposure while wearing a mask, but could be of great relevance due to the blood gas-related volume shifts that take place.

In view of the increased dead space volume, the long-term and increased accumulation and rebreathing of other respiratory air components apart from CO_2 is also unexplained, both in children and in old and sick people. Exhaled air contains over 250 substances, including irritant or toxic gases such as nitrogen oxides (NO), hydrogen sulfide (H2S), isoprene and acetone [170]. For nitrogen oxides [47] and hydrogen sulfide [46], pathological effects relevant to disease have been described in environmental medicine even at a low but chronic exposure [46–48]. Among the volatile organic compounds in exhaled air, acetone and isoprene dominate in terms of quantity, but allyl methyl sulfide, propionic acid and ethanol (some of bacterial origin) should also be mentioned [171]. Whether such substances also react chemically with each other underneath masks and in the dead space volume created by masks (Figure 3), and with the mask tissue itself, and in what quantities these and possible reaction products are rebreathed, has not yet been clarified. In addition to the blood gas changes described above (O_2 drop and CO_2 rise), these effects could also play a role with regard to undesirable mask effects. Further research is needed here and is of particular interest in the case of prolonged and ubiquitous use of masks.

The WHO sees the integration of individual companies and communities that produce their own fabric masks as a potential social and economic benefit. Due to the global shortage of surgical masks and personal protective equipment, it sees this as a source of income and points out that the reuse of fabric masks can reduce costs and waste and contribute to sustainability [2]. In addition to the question of certification procedures for such fabric masks, it should also be mentioned that due to the extensive mask obligation, textile (artificial) substances in the form of micro- and nanoparticles, some of which cannot be degraded in the body, are chronically absorbed into the body through inhalation to an unusual extent. In the case of medical masks, disposable polymers such as polypropylene, polyurethane, polyacrylonitrile, polystyrene, polycarbonate, polyethylene and polyester should be mentioned [140]. ENT physicians have already been able to detect such particles in the nasal mucosa of mask wearers with mucosal reactions in the sense of a foreign body reaction with rhinitis [96]. In the case of community masks, other substances from the textile industry are likely to be added to those mentioned above. The body will try to absorb these substances through macrophages and scavenger cells in the respiratory tract and alveoli as part of a foreign body reaction, whereby toxin release and corresponding local and generalized reactions may occur in an unsuccessful attempt to break them down [172]. Extensive respiratory protection in permanent long-term use (24/7), at least from a theoretical point of view, also potentially carries the risk of leading to a mask-related pulmonary [47] or even generalized disorder, as is already known from textile workers chronically exposed to organic dusts in the Third World (byssinosis) [172].

For the general public, from a scientific angle, it is necessary to draw on the long-standing knowledge of respiratory protection in occupational medicine in order to protect children in particular from harm caused by uncertified masks and improper use.

The universal undefined and extended mask requirement—without taking into account multiple predispositions and susceptibilities—contradicts the claim of an increasingly important individualized medicine with a focus on the unique characteristics of each individual [173].

A systematic review on the topic of masks is necessary according to the results of our scoping review. The primary studies often showed weaknesses in operationalization, especially in the evaluation of cognitive and neuropsychological parameters. Computerized test procedures will be useful here in the future. Mask research should also set itself the future goal of investigating and defining subgroups for whom respiratory protection use is particularly risky.

5. Limitations

Our approach with a focus on negative effects is in line with Villalonga-Olives and Kawachi [12]. With the help of such selective questioning in the sense of dialectics, new insights can be gained that might otherwise have remained hidden. Our literature search focused on adverse negative effects of masks, in particular to point out risks especially for certain patient groups. Therefore, publications presenting only positive effects of masks were not considered in this review.

For a compilation of studies with harmless results when using masks, reference must, therefore, be made to reviews with a different research objective, whereby attention must be paid to possible conflicts of interest there. Some of the studies excluded by us lacking negative effects have shown methodological weaknesses (small, non-uniform experimental groups, missing control group even without masks due to corona constraints, etc.) [174]. In other words, if no negative concomitant effects were described in publications, it does not necessarily mean that masks have exclusively positive effects. It is quite possible that negative effects were simply not mentioned in the literature and the number of negative effects may well be higher than our review suggests.

We only searched one database, so the number of papers on negative mask effects may be higher than we reported.

In order to be able to describe characteristic effects for each mask type even more extensively, we did not have enough scientific data on the respective special designs of the masks. There is still a great need for research in this area due to the current pandemic situation with extensive mandatory masking.

In addition, the experiments evaluated in this paper do not always have uniform measurement parameters and study variables and, depending on the study, take into account the effect of masks at rest or under stress with subjects having different health conditions. Figure 2, therefore, represents a compromise. The results of the primary studies on mask use partially showed no natural variation in parameters, but often showed such clear correlations between symptoms and physiological changes, so that a statistical correlation analysis was not always necessary. We found a statistically significant correlation of oxygen deprivation and fatigue in 58% of the studies ($p < 0.05$). A statistically significant correlation evidence for other parameters has been previously demonstrated in primary studies [21,29].

The most commonly used personal particulate matter protective equipment in the COVID-19 pandemic is the N95 mask [23]. Due to its characteristics (better filtering function, but greater airway resistance and more dead space volume than other masks), the N95 mask is able to highlight negative effects of such protective equipment more clearly than others (Figure 3). Therefore, a relatively frequent consideration and evaluation of N95 masks within the studies found (30 of the 44 quantitatively evaluated studies, 68%) is even advantageous within the framework of our research question. Nevertheless, it remains to be noted that the community masks sold on the market are increasingly similar to the protective equipment that has been better investigated in scientific studies, such as surgical masks and N95 masks, since numerous manufacturers and users of community masks are striving to approximate the professional standard (surgical mask, N95/FFP2). Recent

study results on community masks indicate similar effects for respiratory physiology as described for medical masks: in a recent publication, fabric masks (community masks) also provoked a measurable increase in carbon dioxide $PtcCO_2$ in wearers during exertion and came very close to surgical masks in this effect [21].

Most of the studies cited in our paper included only short observation and application periods (mask-wearing durations investigated ranged from 5 min [26] to 12 h [19]. In only one study, a maximum observation period of an estimated 2-month period was chosen [37]. Therefore, the actual negative effects of masks over a longer application period might be more pronounced than presented in our work.

6. Conclusions

On the one hand, the advocacy of an extended mask requirement remains predominantly theoretical and can only be sustained with individual case reports, plausibility arguments based on model calculations and promising in vitro laboratory tests. Moreover, recent studies on SARS-CoV-2 show both a significantly lower infectivity [175] and a significantly lower case mortality than previously assumed, as it could be calculated that the median corrected infection fatality rate (IFR) was 0.10% in locations with a lower than average global COVID-19 population mortality rate [176]. In early October 2020, the WHO also publicly announced that projections show COVID-19 to be fatal for approximately 0.14% of those who become ill—compared to 0.10% for endemic influenza—again a figure far lower than expected [177].

On the other hand, the side effects of masks are clinically relevant.

In our work, we focused exclusively on the undesirable and negative side effects that can be produced by masks. Valid significant evidence of combined mask-related changes were objectified ($p < 0.05$, $n \geq 50\%$), and we found a clustered and common occurrence of the different adverse effects within the respective studies with significantly measured effects (Figure 2). We were able to demonstrate a statistically significant correlation of the observed adverse effect of hypoxia and the symptom of fatigue with $p < 0.05$ in the quantitative evaluation of the primary studies. Our review of the literature shows that both healthy and sick people can experience Mask-Induced Exhaustion Syndrome (MIES), with typical changes and symptoms that are often observed in combination, such as an increase in breathing dead space volume [22,24,58,59], increase in breathing resistance [31,35,60,61], increase in blood carbon dioxide [13,15,17,19,21–30,35], decrease in blood oxygen saturation [18,19,21,23,28–34], increase in heart rate [23,29,30,35], increase in blood pressure [25,35], decrease in cardiopulmonary capacity [31], increase in respiratory rate [15,21,23,34,36], shortness of breath and difficulty breathing [15,17,19,21,23,25,29,31,34,35,60,71,85,101,133], headache [19,27,29,37,66–68,71,83], dizziness [23,29], feeling hot and clammy [17,22,29,31,35,44,71,85,133], decreased ability to concentrate [29], decreased ability to think [36,37], drowsiness [19,29,32,36,37], decrease in empathy perception [99], impaired skin barrier function [37,72,73] with itching [31,35,67,71–73,91–93], acne, skin lesions and irritation [37,72,73], overall perceived fatigue and exhaustion [15,19,21,29,31,32,34,35,69] (Figures 2–4).

Wearing masks does not consistently cause clinical deviations from the norm of physiological parameters, but according to the scientific literature, a long-term pathological consequence with clinical relevance is to be expected owing to a longer-lasting effect with a subliminal impact and significant shift in the pathological direction. For changes that do not exceed normal values, but are persistently recurring, such as an increase in blood carbon dioxide [38,160], an increase in heart rate [55] or an increase in respiratory rate [56,57], which have been documented while wearing a mask [13,15,17,19,21–30,34,35] (Figure 2), a long-term generation of high blood pressure [25,35], arteriosclerosis and coronary heart disease and of neurological diseases is scientifically obvious [38,55–57,160]. This pathogenetic damage principle with a chronic low-dose exposure with long-term effect, which leads to disease or disease-relevant conditions, has already been extensively studied and described in many areas of environmental medicine [38,46–54]. Extended

mask-wearing would have the potential, according to the facts and correlations we have found, to cause a chronic sympathetic stress response induced by blood gas modifications and controlled by brain centers. This in turn induces and triggers immune suppression and metabolic syndrome with cardiovascular and neurological diseases.

We not only found evidence in the reviewed mask literature of potential long-term effects, but also evidence of an increase in direct short-term effects with increased mask-wearing time in terms of cumulative effects for: carbon dioxide retention, drowsiness, headache, feeling of exhaustion, skin irritation (redness, itching) and microbiological contamination (germ colonization) [19,22,37,66,68,69,89,91,92].

Overall, the exact frequency of the described symptom constellation MIES in the mask-using populace remains unclear and cannot be estimated due to insufficient data.

Theoretically, the mask-induced effects of the drop in blood gas oxygen and increase in carbon dioxide extend to the cellular level with induction of the transcription factor HIF (hypoxia-induced factor) and increased inflammatory and cancer-promoting effects [160] and can, thus, also have a negative influence on pre-existing clinical pictures.

In any case, the MIES potentially triggered by masks (Figures 3 and 4) contrasts with the WHO definition of health: "health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." [178].

All the scientific facts found in our work expand the knowledge base for a differentiated view of the mask debate. This gain can be relevant for decision makers who have to deal with the issue of mandatory mask use during the pandemic under constant review of proportionality as well as for physicians who can advise their patients more appropriately on this basis. For certain diseases, taking into account the literature found in this study, it is also necessary for the attending physician to weigh up the benefits and risks with regard to a mask obligation. With an overall strictly scientific consideration, a recommendation for mask exemption can become justifiable within the framework of a medical appraisal (Figure 5).

Increased risk of adverse effects when using masks:

Internal diseases
COPD
Sleep Apnea Syndrome
advanced renal Failure
Obesity
Cardiopulmonary Dysfunction
Asthma

Psychiatric illness
Claustrophobia
Panic Disorder
Personality Disorders
Dementia
Schizophrenia
helpless Patients
fixed and sedated Patients

Neurological Diseases
Migraines and Headache Sufferers
Patients with intracranial Masses
Epilepsy

Pediatric Diseases
Asthma
Respiratory diseases
Cardiopulmonary Diseases
Neuromuscular Diseases
Epilepsy

ENT Diseases
Vocal Cord Disorders
Rhinitis and obstructive Diseases

Dermatological Diseases
Acne
Atopic

Occupational Health Restrictions
moderate / heavy physical Work

Gynecological restrictions
Pregnant Women

Figure 5. Diseases/predispositions with significant risks, according to the literature found, when using masks. Indications for weighing up medical mask exemption certificates.

In addition to protecting the health of their patients, doctors should also base their actions on the guiding principle of the 1948 Geneva Declaration, as revised in 2017. According to this, every doctor vows to put the health and dignity of his patient first and, even under threat, not to use his medical knowledge to violate human rights and civil liberties [9]. Within the framework of these findings, we, therefore, propagate an explicitly medically judicious, legally compliant action in consideration of scientific factual reality [2,4,5,16,130,132,143,175–177] against a predominantly assumption-led claim to a general effectiveness of masks, always taking into account possible unwanted individual ef-

fects for the patient and mask wearer concerned, entirely in accordance with the principles of evidence-based medicine and the ethical guidelines of a physician.

The results of the present literature review could help to include mask-wearing in the differential diagnostic pathophysiological cause consideration of every physician when corresponding symptoms are present (MIES, Figure 4). In this way, the physician can draw on an initial complaints catalogue that may be associated with mask-wearing (Figure 2) and also exclude certain diseases from the general mask requirement (Figure 5).

For scientists, the prospect of continued mask use in everyday life suggests areas for further research. In our view, further research is particularly desirable in the gynecological (fetal and embryonic) and pediatric fields, as children are a vulnerable group that would face the longest and, thus, most profound consequences of a potentially risky mask use. Basic research at the cellular level regarding mask-induced triggering of the transcription factor HIF with potential promotion of immunosuppression and carcinogenicity also appears to be useful under this circumstance. Our scoping review shows the need for a systematic review.

The described mask-related changes in respiratory physiology can have an adverse effect on the wearer's blood gases sub-clinically and in some cases also clinically manifest and, therefore, have a negative effect on the basis of all aerobic life, external and internal respiration, with an influence on a wide variety of organ systems and metabolic processes with physical, psychological and social consequences for the individual human being.

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References

1. World Health Organization. *WHO-Advice on the Use of Masks in the Context of COVID-19: Interim Guidance, 6 April 2020*; World Health Organization: Geneva, Switzerland, 2020; Available online: https://apps.who.int/iris/handle/10665/331693 (accessed on 7 November 2020).
2. World Health Organization. *WHO-Advice on the Use of Masks in the Context of COVID-19: Interim Guidance, 5 June 2020*; World Health Organization: Geneva, Switzerland, 2020; Available online: https://apps.who.int/iris/handle/10665/332293 (accessed on 7 November 2020).
3. Chu, D.K.; Akl, E.A.; Duda, S.; Solo, K.; Yaacoub, S.; Schünemann, H.J.; Chu, D.K.; Akl, E.A.; El-harakeh, A.; Bognanni, A.; et al. Physical Distancing, Face Masks, and Eye Protection to Prevent Person-to-Person Transmission of SARS-CoV-2 and COVID-19: A Systematic Review and Meta-Analysis. *Lancet* **2020**, *395*, 1973–1987. [CrossRef]
4. Jefferson, T.; Jones, M.; Ansari, L.A.A.; Bawazeer, G.; Beller, E.; Clark, J.; Conly, J.; Mar, C.D.; Dooley, E.; Ferroni, E.; et al. Physical Interventions to Interrupt or Reduce the Spread of Respiratory Viruses. Part 1-Face Masks, Eye Protection and Person Distancing: Systematic Review and Meta-Analysis. *medRxiv* **2020**. [CrossRef]
5. Kappstein, I. Mund-Nasen-Schutz in der Öffentlichkeit: Keine Hinweise für eine Wirksamkeit. *Krankenh. Up2date* **2020**, *15*, 279–295. [CrossRef]
6. De Brouwer, C. Wearing a Mask, a Universal Solution against COVID-19 or an Additional Health Risk? 2020. Available online: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3676885 (accessed on 12 November 2020). [CrossRef]
7. Ewig, S.; Gatermann, S.; Lemmen, S. Die Maskierte Gesellschaft. *Pneumologie* **2020**, *74*, 405–408. [CrossRef] [PubMed]

8. Great Barrington Declaration Great Barrington Declaration and Petition. Available online: https://gbdeclaration.org/ (accessed on 9 November 2020).
9. WMA-The World Medical Association-WMA Declaration of Geneva. Available online: https://www.wma.net/policies-post/wma-declaration-of-geneva/ (accessed on 7 November 2020).
10. WMA-The World Medical Association-WMA Declaration of Helsinki–Ethical Principles for Medical Research Involving Human Subjects. Available online: https://www.wma.net/policies-post/wma-declaration-of-geneva/ (accessed on 7 November 2020).
11. WMA-The World Medical Association-WMA Declaration of Lisbon on the Rights of the Patient. Available online: https://www.wma.net/policies-post/wma-declaration-of-lisbon-on-the-rights-of-the-patient/ (accessed on 7 November 2020).
12. Villalonga-Olives, E.; Kawachi, I. The Dark Side of Social Capital: A Systematic Review of the Negative Health Effects of Social Capital. *Soc. Sci. Med.* **2017**, *194*, 105–127. [CrossRef]
13. Butz, U. Rückatmung von Kohlendioxid bei Verwendung von Operationsmasken als hygienischer Mundschutz an medizinischem Fachpersonal. Ph.D. Thesis, Fakultät für Medizin der Technischen Universität München, Munich, Germany, 2005.
14. Smolka, L.; Borkowski, J.; Zaton, M. The Effect of Additional Dead Space on Respiratory Exchange Ratio and Carbon Dioxide Production Due to Training. *J. Sports Sci. Med.* **2014**, *13*, 36–43. [PubMed]
15. Roberge, R.J.; Kim, J.-H.; Benson, S.M. Absence of Consequential Changes in Physiological, Thermal and Subjective Responses from Wearing a Surgical Mask. *Respir. Physiol. Neurobiol.* **2012**, *181*, 29–35. [CrossRef] [PubMed]
16. Matuschek, C.; Moll, F.; Fangerau, H.; Fischer, J.C.; Zänker, K.; van Griensven, M.; Schneider, M.; Kindgen-Milles, D.; Knoefel, W.T.; Lichtenberg, A.; et al. Face Masks: Benefits and Risks during the COVID-19 Crisis. *Eur. J. Med. Res.* **2020**, *25*, 32. [CrossRef]
17. Roberge, R.J.; Coca, A.; Williams, W.J.; Powell, J.B.; Palmiero, A.J. Physiological Impact of the N95 Filtering Facepiece Respirator on Healthcare Workers. *Respir. Care* **2010**, *55*, 569–577.
18. Pifarré, F.; Zabala, D.D.; Grazioli, G.; de Yzaguirre i Maura, I. COVID 19 and Mask in Sports. *Apunt. Sports Med.* **2020**. [CrossRef]
19. Rebmann, T.; Carrico, R.; Wang, J. Physiologic and Other Effects and Compliance with Long-Term Respirator Use among Medical Intensive Care Unit Nurses. *Am. J. Infect. Control* **2013**, *41*, 1218–1223. [CrossRef]
20. Roeckner, J.T.; Krstić, N.; Sipe, B.H.; Običan, S.G. N95 Filtering Facepiece Respirator Use during Pregnancy: A Systematic Review. *Am. J. Perinatol.* **2020**, *37*, 995–1001. [CrossRef]
21. Georgi, C.; Haase-Fielitz, A.; Meretz, D.; Gäsert, L.; Butter, C. Einfluss gängiger Gesichtsmasken auf physiologische Parameter und Belastungsempfinden unter arbeitstypischer körperlicher Anstrengung. *Deutsches Ärzteblatt* **2020**, 674–675. [CrossRef]
22. Roberge, R.J.; Kim, J.-H.; Powell, J.B. N95 Respirator Use during Advanced Pregnancy. *Am. J. Infect. Control* **2014**, *42*, 1097–1100. [CrossRef]
23. Kyung, S.Y.; Kim, Y.; Hwang, H.; Park, J.-W.; Jeong, S.H. Risks of N95 Face Mask Use in Subjects with COPD. *Respir. Care* **2020**, *65*, 658–664. [CrossRef]
24. Epstein, D.; Korytny, A.; Isenberg, Y.; Marcusohn, E.; Zukermann, R.; Bishop, B.; Minha, S.; Raz, A.; Miller, A. Return to Training in the COVID-19 Era: The Physiological Effects of Face Masks during Exercise. *Scand. J. Med. Sci. Sports* **2020**. [CrossRef]
25. Mo, Y.; Wei, D.; Mai, Q.; Chen, C.; Yu, H.; Jiang, C.; Tan, X. Risk and Impact of Using Mask on COPD Patients with Acute Exacerbation during the COVID-19 Outbreak: A Retrospective Study. *Res. Sq.* **2020**. [CrossRef]
26. Goh, D.Y.T.; Mun, M.W.; Lee, W.L.J.; Teoh, O.H.; Rajgor, D.D. A Randomised Clinical Trial to Evaluate the Safety, Fit, Comfort of a Novel N95 Mask in Children. *Sci. Rep.* **2019**, *9*, 18952. [CrossRef]
27. Bharatendu, C.; Ong, J.J.Y.; Goh, Y.; Tan, B.Y.Q.; Chan, A.C.Y.; Tang, J.Z.Y.; Leow, A.S.; Chin, A.; Sooi, K.W.X.; Tan, Y.L.; et al. Powered Air Purifying Respirator (PAPR) Restores the N95 Face Mask Induced Cerebral Hemodynamic Alterations among Healthcare Workers during COVID-19 Outbreak. *J. Neurol. Sci.* **2020**, *417*, 117078. [CrossRef]
28. Tong, P.S.Y.; Kale, A.S.; Ng, K.; Loke, A.P.; Choolani, M.A.; Lim, C.L.; Chan, Y.H.; Chong, Y.S.; Tambyah, P.A.; Yong, E.-L. Respiratory Consequences of N95-Type Mask Usage in Pregnant Healthcare Workers—A Controlled Clinical Study. *Antimicrob. Resist. Infect. Control* **2015**, *4*, 48. [CrossRef]
29. Liu, C.; Li, G.; He, Y.; Zhang, Z.; Ding, Y. Effects of Wearing Masks on Human Health and Comfort during the COVID-19 Pandemic. *IOP Conf. Ser. Earth Environ. Sci.* **2020**, *531*, 012034. [CrossRef]
30. Beder, A.; Büyükkoçak, U.; Sabuncuoğlu, H.; Keskil, Z.A.; Keskil, S. Preliminary Report on Surgical Mask Induced Deoxygenation during Major Surgery. *Neurocirugía* **2008**, *19*, 121–126. [CrossRef]
31. Fikenzer, S.; Uhe, T.; Lavall, D.; Rudolph, U.; Falz, R.; Busse, M.; Hepp, P.; Laufs, U. Effects of Surgical and FFP2/N95 Face Masks on Cardiopulmonary Exercise Capacity. *Clin. Res. Cardiol.* **2020**, *109*, 1522–1530. [CrossRef] [PubMed]
32. Jagim, A.R.; Dominy, T.A.; Camic, C.L.; Wright, G.; Doberstein, S.; Jones, M.T.; Oliver, J.M. Acute Effects of the Elevation Training Mask on Strength Performance in Recreational Weight Lifters. *J. Strength Cond. Res.* **2018**, *32*, 482–489. [CrossRef]
33. Porcari, J.P.; Probst, L.; Forrester, K.; Doberstein, S.; Foster, C.; Cress, M.L.; Schmidt, K. Effect of Wearing the Elevation Training Mask on Aerobic Capacity, Lung Function, and Hematological Variables. *J. Sports Sci. Med.* **2016**, *15*, 379–386.
34. Kao, T.-W.; Huang, K.-C.; Huang, Y.-L.; Tsai, T.-J.; Hsieh, B.-S.; Wu, M.-S. The Physiological Impact of Wearing an N95 Mask during Hemodialysis as a Precaution against SARS in Patients with End-Stage Renal Disease. *J. Formos. Med. Assoc.* **2004**, *103*, 624–628.
35. Li, Y.; Tokura, H.; Guo, Y.P.; Wong, A.S.W.; Wong, T.; Chung, J.; Newton, E. Effects of Wearing N95 and Surgical Facemasks on Heart Rate, Thermal Stress and Subjective Sensations. *Int. Arch. Occup. Environ. Health* **2005**, *78*, 501–509. [CrossRef]
36. Johnson, A.T. Respirator Masks Protect Health but Impact Performance: A Review. *J. Biol. Eng.* **2016**, *10*, 4. [CrossRef]

37. Rosner, E. Adverse Effects of Prolonged Mask Use among Healthcare Professionals during COVID-19. *J. Infect. Dis. Epidemiol.* **2020**. [CrossRef]
38. Azuma, K.; Kagi, N.; Yanagi, U.; Osawa, H. Effects of Low-Level Inhalation Exposure to Carbon Dioxide in Indoor Environments: A Short Review on Human Health and Psychomotor Performance. *Environ. Int.* **2018**, *121*, 51–56. [CrossRef]
39. Drechsler, M.; Morris, J. Carbon Dioxide Narcosis. In *StatPearls*; StatPearls Publishing: Treasure Island, FL, USA, 2020.
40. Noble, J.; Jones, J.G.; Davis, E.J. Cognitive Function during Moderate Hypoxaemia. *Anaesth. Intensive Care* **1993**, *21*, 180–184. [CrossRef]
41. Fothergill, D.M.; Hedges, D.; Morrison, J.B. Effects of CO_2 and N_2 Partial Pressures on Cognitive and Psychomotor Performance. *Undersea Biomed. Res.* **1991**, *18*, 1–19.
42. Spitzer, M. Masked Education? The Benefits and Burdens of Wearing Face Masks in Schools during the Current Corona Pandemic. *Trends Neurosci. Educ.* **2020**, *20*, 100138. [CrossRef]
43. Heider, C.A.; Álvarez, M.L.; Fuentes-López, E.; González, C.A.; León, N.I.; Verástegui, D.C.; Badía, P.I.; Napolitano, C.A. Prevalence of Voice Disorders in Healthcare Workers in the Universal Masking COVID-19 Era. *Laryngoscope* **2020**. [CrossRef]
44. Roberge, R.J.; Kim, J.-H.; Coca, A. Protective Facemask Impact on Human Thermoregulation: An Overview. *Ann. Occup. Hyg.* **2012**, *56*, 102–112. [CrossRef]
45. Palmiero, A.J.; Symons, D.; Morgan, J.W.; Shaffer, R.E. Speech Intelligelibility Assessment of Protective Facemasks and Air-Purifying Respirators. *J. Occup. Environ. Hyg.* **2016**, *13*, 960–968. [CrossRef]
46. Simonton, D.; Spears, M. Human Health Effects from Exposure to Low-Level Concentrations of Hydrogen Sulfide. *Occup. Health Saf. (Waco Tex.)* **2007**, *76*, 102–104.
47. Salimi, F.; Morgan, G.; Rolfe, M.; Samoli, E.; Cowie, C.T.; Hanigan, I.; Knibbs, L.; Cope, M.; Johnston, F.H.; Guo, Y.; et al. Long-Term Exposure to Low Concentrations of Air Pollutants and Hospitalisation for Respiratory Diseases: A Prospective Cohort Study in Australia. *Environ. Int.* **2018**, *121*, 415–420. [CrossRef]
48. Dominici, F.; Schwartz, J.; Di, Q.; Braun, D.; Choirat, C.; Zanobetti, A. *Assessing Adverse Health Effects of Long-Term Exposure to Low Levels of Ambient Air Pollution: Phase 1 Research Report*; Health Effects Institute: Boston, MA, USA, 2019; pp. 1–51.
49. Alleva, R.; Manzella, N.; Gaetani, S.; Bacchetti, T.; Bracci, M.; Ciarapica, V.; Monaco, F.; Borghi, B.; Amati, M.; Ferretti, G.; et al. Mechanism Underlying the Effect of Long-Term Exposure to Low Dose of Pesticides on DNA Integrity. *Environ. Toxicol.* **2018**, *33*, 476–487. [CrossRef]
50. Roh, T.; Lynch, C.F.; Weyer, P.; Wang, K.; Kelly, K.M.; Ludewig, G. Low-Level Arsenic Exposure from Drinking Water Is Associated with Prostate Cancer in Iowa. *Environ. Res.* **2017**, *159*, 338–343. [CrossRef]
51. Deering, K.E.; Callan, A.C.; Prince, R.L.; Lim, W.H.; Thompson, P.L.; Lewis, J.R.; Hinwood, A.L.; Devine, A. Low-Level Cadmium Exposure and Cardiovascular Outcomes in Elderly Australian Women: A Cohort Study. *Int. J. Hyg. Environ. Health* **2018**, *221*, 347–354. [CrossRef] [PubMed]
52. Kosnett, M. Health Effects of Low Dose Lead Exposure in Adults and Children, and Preventable Risk Posed by the Consumption of Game Meat Harvested with Lead Ammunition. In *Ingestion of Lead from Spent Ammunition: Implications for Wildlife and Humans*; The Peregrine Fund: Boise, ID, USA, 2009. [CrossRef]
53. Crinnion, W.J. Environmental Medicine, Part Three: Long-Term Effects of Chronic Low-Dose Mercury Exposure. *Altern. Med. Rev.* **2000**, *5*, 209–223. [PubMed]
54. Wu, S.; Han, J.; Vleugels, R.A.; Puett, R.; Laden, F.; Hunter, D.J.; Qureshi, A.A. Cumulative Ultraviolet Radiation Flux in Adulthood and Risk of Incident Skin Cancers in Women. *Br. J. Cancer* **2014**, *110*, 1855–1861. [CrossRef] [PubMed]
55. Custodis, F.; Schirmer, S.H.; Baumhäkel, M.; Heusch, G.; Böhm, M.; Laufs, U. Vascular Pathophysiology in Response to Increased Heart Rate. *J. Am. Coll. Cardiol.* **2010**, *56*, 1973–1983. [CrossRef]
56. Russo, M.A.; Santarelli, D.M.; O'Rourke, D. The Physiological Effects of Slow Breathing in the Healthy Human. *Breathe* **2017**, *13*, 298–309. [CrossRef]
57. Nuckowska, M.K.; Gruszecki, M.; Kot, J.; Wolf, J.; Guminski, W.; Frydrychowski, A.F.; Wtorek, J.; Narkiewicz, K.; Winklewski, P.J. Impact of Slow Breathing on the Blood Pressure and Subarachnoid Space Width Oscillations in Humans. *Sci. Rep.* **2019**, *9*, 6232. [CrossRef]
58. Johnson, A.T.; Scott, W.H.; Lausted, C.G.; Coyne, K.M.; Sahota, M.S.; Johnson, M.M. Effect of External Dead Volume on Performance While Wearing a Respirator. *AIHAJ-Am. Ind. Hyg. Assoc.* **2000**, *61*, 678–684. [CrossRef]
59. Xu, M.; Lei, Z.; Yang, J. Estimating the Dead Space Volume between a Headform and N95 Filtering Facepiece Respirator Using Microsoft Kinect. *J. Occup. Environ. Hyg.* **2015**, *12*, 538–546. [CrossRef]
60. Lee, H.P.; Wang, D.Y. Objective Assessment of Increase in Breathing Resistance of N95 Respirators on Human Subjects. *Ann. Occup. Hyg.* **2011**, *55*, 917–921. [CrossRef]
61. Roberge, R.; Bayer, E.; Powell, J.; Coca, A.; Roberge, M.; Benson, S. Effect of Exhaled Moisture on Breathing Resistance of N95 Filtering Facepiece Respirators. *Ann. Occup. Hyg.* **2010**, *54*, 671–677. [CrossRef]
62. Jamjoom, A.; Nikkar-Esfahani, A.; Fitzgerald, J. Operating Theatre Related Syncope in Medical Students: A Cross Sectional Study. *BMC Med. Educ.* **2009**, *9*, 14. [CrossRef]
63. Asadi-Pooya, A.A.; Cross, J.H. Is Wearing a Face Mask Safe for People with Epilepsy? *Acta Neurol. Scand.* **2020**, *142*, 314–316. [CrossRef]

64. Lazzarino, A.I.; Steptoe, A.; Hamer, M.; Michie, S. Covid-19: Important Potential Side Effects of Wearing Face Masks That We Should Bear in Mind. *BMJ* **2020**, *369*, m2003. [CrossRef]
65. Guaranha, M.S.B.; Garzon, E.; Buchpiguel, C.A.; Tazima, S.; Yacubian, E.M.T.; Sakamoto, A.C. Hyperventilation Revisited: Physiological Effects and Efficacy on Focal Seizure Activation in the Era of Video-EEG Monitoring. *Epilepsia* **2005**, *46*, 69–75. [CrossRef]
66. Ong, J.J.Y.; Bharatendu, C.; Goh, Y.; Tang, J.Z.Y.; Sooi, K.W.X.; Tan, Y.L.; Tan, B.Y.Q.; Teoh, H.-L.; Ong, S.T.; Allen, D.M.; et al. Headaches Associated With Personal Protective Equipment-A Cross-Sectional Study among Frontline Healthcare Workers During COVID-19. *Headache* **2020**, *60*, 864–877. [CrossRef]
67. Jacobs, J.L.; Ohde, S.; Takahashi, O.; Tokuda, Y.; Omata, F.; Fukui, T. Use of Surgical Face Masks to Reduce the Incidence of the Common Cold among Health Care Workers in Japan: A Randomized Controlled Trial. *Am. J. Infect. Control* **2009**, *37*, 417–419. [CrossRef]
68. Ramirez-Moreno, J.M. Mask-Associated de Novo Headache in Healthcare Workers during the Covid-19 Pandemic. *medRxiv* **2020**. [CrossRef]
69. Shenal, B.V.; Radonovich, L.J.; Cheng, J.; Hodgson, M.; Bender, B.S. Discomfort and Exertion Associated with Prolonged Wear of Respiratory Protection in a Health Care Setting. *J. Occup. Environ. Hyg.* **2011**, *9*, 59–64. [CrossRef]
70. Rains, S.A. The Nature of Psychological Reactance Revisited: A Meta-Analytic Review. *Hum. Commun. Res.* **2013**, *39*, 47–73. [CrossRef]
71. Matusiak, Ł.; Szepietowska, M.; Krajewski, P.; Białynicki-Birula, R.; Szepietowski, J.C. Inconveniences Due to the Use of Face Masks during the COVID-19 Pandemic: A Survey Study of 876 Young People. *Dermatol. Ther.* **2020**, *33*, e13567. [CrossRef]
72. Foo, C.C.I.; Goon, A.T.J.; Leow, Y.; Goh, C. Adverse Skin Reactions to Personal Protective Equipment against Severe Acute Respiratory Syndrome–a Descriptive Study in Singapore. *Contact Dermat.* **2006**, *55*, 291–294. [CrossRef]
73. Hua, W.; Zuo, Y.; Wan, R.; Xiong, L.; Tang, J.; Zou, L.; Shu, X.; Li, L. Short-Term Skin Reactions Following Use of N95 Respirators and Medical Masks. *Contact Dermat.* **2020**, *83*, 115–121. [CrossRef]
74. Prousa, D. Studie zu psychischen und psychovegetativen Beschwerden mit den aktuellen Mund-Nasenschutz-Verordnungen. *PsychArchives* **2020**. [CrossRef]
75. Sell, T.K.; Hosangadi, D.; Trotochaud, M. Misinformation and the US Ebola Communication Crisis: Analyzing the Veracity and Content of Social Media Messages Related to a Fear-Inducing Infectious Disease Outbreak. *BMC Public Health* **2020**, *20*, 550. [CrossRef]
76. Ryan, R.M.; Deci, E.L. Self-determination theory and the role of basic psychological needs in personality and the organization of behavior. In *Handbook of Personality: Theory and Research*, 3rd ed.; The Guilford Press: New York, NY, USA, 2008; pp. 654–678. ISBN 978-1-59385-836-0.
77. Kent, J.M.; Papp, L.A.; Martinez, J.M.; Browne, S.T.; Coplan, J.D.; Klein, D.F.; Gorman, J.M. Specificity of Panic Response to CO(2) Inhalation in Panic Disorder: A Comparison with Major Depression and Premenstrual Dysphoric Disorder. *Am. J. Psychiatry* **2001**, *158*, 58–67. [CrossRef] [PubMed]
78. Morris, L.S.; McCall, J.G.; Charney, D.S.; Murrough, J.W. The Role of the Locus Coeruleus in the Generation of Pathological Anxiety. *Brain Neurosci. Adv.* **2020**, *4*. [CrossRef] [PubMed]
79. Gorman, J.M.; Askanazi, J.; Liebowitz, M.R.; Fyer, A.J.; Stein, J.; Kinney, J.M.; Klein, D.F. Response to Hyperventilation in a Group of Patients with Panic Disorder. *Am. J. Psychiatry* **1984**, *141*, 857–861. [CrossRef] [PubMed]
80. Tsugawa, A.; Sakurai, S.; Inagawa, Y.; Hirose, D.; Kaneko, Y.; Ogawa, Y.; Serisawa, S.; Takenoshita, N.; Sakurai, H.; Kanetaka, H.; et al. Awareness of the COVID-19 Outbreak and Resultant Depressive Tendencies in Patients with Severe Alzheimer's Disease. *JAD* **2020**, *77*, 539–541. [CrossRef]
81. Maguire, P.A.; Reay, R.E.; Looi, J.C. Nothing to Sneeze at-Uptake of Protective Measures against an Influenza Pandemic by People with Schizophrenia: Willingness and Perceived Barriers. *Australas. Psychiatry* **2019**, *27*, 171–178. [CrossRef]
82. COVID-19: Considerations for Wearing Masks | CDC. Available online: https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cloth-face-cover-guidance.html (accessed on 12 November 2020).
83. Lim, E.C.H.; Seet, R.C.S.; Lee, K.-H.; Wilder-Smith, E.P.V.; Chuah, B.Y.S.; Ong, B.K.C. Headaches and the N95 Face-mask amongst Healthcare Providers. *Acta Neurol. Scand.* **2006**, *113*, 199–202. [CrossRef]
84. Badri, F.M.A. Surgical Mask Contact Dermatitis and Epidemiology of Contact Dermatitis in Healthcare Workers. *Curr. Allergy Clin. Immunol.* **2017**, *30*, 183–188.
85. Scarano, A.; Inchingolo, F.; Lorusso, F. Facial Skin Temperature and Discomfort When Wearing Protective Face Masks: Thermal Infrared Imaging Evaluation and Hands Moving the Mask. *Int. J. Environ. Res. Public Health* **2020**, *17*, 4624. [CrossRef]
86. Luksamijarulkul, P.; Aiempradit, N.; Vatanasomboon, P. Microbial Contamination on Used Surgical Masks among Hospital Personnel and Microbial Air Quality in Their Working Wards: A Hospital in Bangkok. *Oman Med. J.* **2014**, *29*, 346–350. [CrossRef]
87. Chughtai, A.A.; Stelzer-Braid, S.; Rawlinson, W.; Pontivivo, G.; Wang, Q.; Pan, Y.; Zhang, D.; Zhang, Y.; Li, L.; MacIntyre, C.R. Contamination by Respiratory Viruses on Outer Surface of Medical Masks Used by Hospital Healthcare Workers. *BMC Infect. Dis.* **2019**, *19*, 491. [CrossRef]
88. Monalisa, A.C.; Padma, K.B.; Manjunath, K.; Hemavathy, E.; Varsha, D. Microbial Contamination of the Mouth Masks Used by Post-Graduate Students in a Private Dental Institution: An In-Vitro Study. *IOSR J. Dent. Med. Sci.* **2017**, *16*, 61–67.
89. Liu, Z.; Chang, Y.; Chu, W.; Yan, M.; Mao, Y.; Zhu, Z.; Wu, H.; Zhao, J.; Dai, K.; Li, H.; et al. Surgical Masks as Source of Bacterial Contamination during Operative Procedures. *J. Orthop. Transl.* **2018**, *14*, 57–62. [CrossRef]

90. Robert Koch-Institut. *Influenza-Monatsbericht*; Robert Koch-Institut: Berlin, Germany, 2020.
91. Techasatian, L.; Lebsing, S.; Uppala, R.; Thaowandee, W.; Chaiyarit, J.; Supakunpinyo, C.; Panombualert, S.; Mairiang, D.; Saengnipanthkul, S.; Wichajarn, K.; et al. The Effects of the Face Mask on the Skin Underneath: A Prospective Survey During the COVID-19 Pandemic. *J. Prim. Care Community Health* **2020**, *11*, 2150132720966167. [CrossRef]
92. Lan, J.; Song, Z.; Miao, X.; Li, H.; Li, Y.; Dong, L.; Yang, J.; An, X.; Zhang, Y.; Yang, L.; et al. Skin Damage among Health Care Workers Managing Coronavirus Disease-2019. *J. Am. Acad. Dermatol.* **2020**, *82*, 1215–1216. [CrossRef]
93. Szepietowski, J.C.; Matusiak, Ł.; Szepietowska, M.; Krajewski, P.K.; Białynicki-Birula, R. Face Mask-Induced Itch: A Self-Questionnaire Study of 2,315 Responders during the COVID-19 Pandemic. *Acta Derm.-Venereol.* **2020**, *100*, adv00152. [CrossRef]
94. Darlenski, R.; Tsankov, N. COVID-19 Pandemic and the Skin: What Should Dermatologists Know? *Clin. Dermatol.* **2020**. [CrossRef]
95. Muley, P.; 'Mask Mouth'-a Novel Threat to Oral Health in the COVID Era–Dr Pooja Muley. Dental Tribune South Asia 2020. Available online: https://in.dental-tribune.com/news/mask-mouth-a-novel-threat-to-oral-health-in-the-covid-era/ (accessed on 12 November 2020).
96. Klimek, L.; Huppertz, T.; Alali, A.; Spielhaupter, M.; Hörmann, K.; Matthias, C.; Hagemann, J. A New Form of Irritant Rhinitis to Filtering Facepiece Particle (FFP) Masks (FFP2/N95/KN95 Respirators) during COVID-19 Pandemic. *World Allergy Organ. J.* **2020**, *13*, 100474. [CrossRef]
97. COVID-19 Mythbusters–World Health Organization. Available online: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public/myth-busters (accessed on 28 January 2021).
98. Asadi, S.; Cappa, C.D.; Barreda, S.; Wexler, A.S.; Bouvier, N.M.; Ristenpart, W.D. Efficacy of Masks and Face Coverings in Controlling Outward Aerosol Particle Emission from Expiratory Activities. *Sci. Rep.* **2020**, *10*, 15665. [CrossRef]
99. Wong, C.K.M.; Yip, B.H.K.; Mercer, S.; Griffiths, S.; Kung, K.; Wong, M.C.; Chor, J.; Wong, S.Y. Effect of Facemasks on Empathy and Relational Continuity: A Randomised Controlled Trial in Primary Care. *BMC Fam. Pract.* **2013**, *14*, 200. [CrossRef]
100. World Health Organization; United Nations Children's Fund. *WHO-Advice on the Use of Masks for Children in the Community in the Context of COVID-19: Annex to the Advice on the Use of Masks in the Context of COVID-19, 21 August 2020*; World Health Organization: Geneva, Switzerland, 2020.
101. Person, E.; Lemercier, C.; Royer, A.; Reychler, G. Effet du port d'un masque de soins lors d'un test de marche de six minutes chez des sujets sains. *Rev. Mal. Respir.* **2018**, *35*, 264–268. [CrossRef]
102. Johnson, A.T.; Scott, W.H.; Phelps, S.J.; Caretti, D.M.; Koh, F.C. How Is Respirator Comfort Affected by Respiratory Resistance? *J. Int. Soc. Respir. Prot.* **2005**, *22*, 38.
103. Koh, F.C.; Johnson, A.T.; Scott, W.H.; Phelps, S.J.; Francis, E.B.; Cattungal, S. The Correlation between Personality Type and Performance Time While Wearing a Respirator. *J. Occup. Environ. Hyg.* **2006**, *3*, 317–322. [CrossRef]
104. Deutsche Gesetzliche Unfallversicherung. *DGUV Grundsätze für Arbeitsmedizinische Vorsorgeuntersuchungen*; Alfons, W., Ed.; Gentner Verlag: Stuttgart, Germany, 2010; ISBN 978-3-87247-733-0.
105. Browse by Country-NATLEX. Available online: https://www.ilo.org/dyn/natlex/natlex4.byCountry?p_lang=en (accessed on 28 January 2021).
106. BAuA-SARS-CoV-2 FAQ Und Weitere Informationen-Kennzeichnung von Masken Aus USA, Kanada, Australien/Neuseeland, Japan, China Und Korea-Bundesanstalt Für Arbeitsschutz Und Arbeitsmedizin. Available online: https://www.baua.de/DE/Themen/Arbeitsgestaltung-im-Betrieb/Coronavirus/pdf/Kennzeichnung-Masken.html (accessed on 28 January 2021).
107. Veit, M. Hauptsache Maske!? *DAZ.Online*. 2020, p. S26. Available online: https://www.deutsche-apotheker-zeitung.de/daz-az/2020/daz-33-2020/hauptsache-maske (accessed on 12 November 2020).
108. MacIntyre, C.R.; Seale, H.; Dung, T.C.; Hien, N.T.; Nga, P.T.; Chughtai, A.A.; Rahman, B.; Dwyer, D.E.; Wang, Q. A Cluster Randomised Trial of Cloth Masks Compared with Medical Masks in Healthcare Workers. *BMJ Open* **2015**, *5*, e006577. [CrossRef]
109. MacIntyre, C.R.; Chughtai, A.A. Facemasks for the Prevention of Infection in Healthcare and Community Settings. *BMJ* **2015**, *350*, h694. [CrossRef]
110. MacIntyre, C.R.; Wang, Q.; Seale, H.; Yang, P.; Shi, W.; Gao, Z.; Rahman, B.; Zhang, Y.; Wang, X.; Newall, A.T.; et al. A Randomized Clinical Trial of Three Options for N95 Respirators and Medical Masks in Health Workers. *Am. J. Respir. Crit. Care Med.* **2013**, *187*, 960–966. [CrossRef]
111. Dellweg, D.; Lepper, P.M.; Nowak, D.; Köhnlein, T.; Olgemöller, U.; Pfeifer, M. Position Paper of the German Respiratory Society (DGP) on the Impact of Community Masks on Self-Protection and Protection of Others in Regard to Aerogen Transmitted Diseases. *Pneumologie* **2020**, *74*, 331–336. [CrossRef]
112. Luckman, A.; Zeitoun, H.; Isoni, A.; Loomes, G.; Vlaev, I.; Powdthavee, N.; Read, D. Risk Compensation during COVID-19: The Impact of Face Mask Usage on Social Distancing. *OSF Preprints*. 2020. Available online: https://osf.io/rb8he/ (accessed on 25 October 2020).
113. Sharma, I.; Vashnav, M.; Sharma, R. COVID-19 Pandemic Hype: Losers and Gainers. *Indian J. Psychiatry* **2020**, *62*, S420–S430. [CrossRef] [PubMed]
114. BfArM-Empfehlungen Des BfArM-Hinweise Des BfArM Zur Verwendung von Mund–Nasen-Bedeckungen (z.B. Selbst Hergestellten Masken, "Community-Oder DIY-Masken"), Medizinischen Gesichtsmasken Sowie Partikelfiltrierenden Halbmasken (FFP1, FFP2 Und FFP3) Im Zusammenhang Mit Dem Coronavirus (SARS-CoV-2/Covid-19). Available online: https://www.bfarm.de/SharedDocs/Risikoinformationen/Medizinprodukte/DE/schutzmasken.html (accessed on 12 November 2020).

115. MacIntyre, C.R.; Wang, Q.; Cauchemez, S.; Seale, H.; Dwyer, D.E.; Yang, P.; Shi, W.; Gao, Z.; Pang, X.; Zhang, Y.; et al. A Cluster Randomized Clinical Trial Comparing Fit-Tested and Non-Fit-Tested N95 Respirators to Medical Masks to Prevent Respiratory Virus Infection in Health Care Workers. *Influenza Other Respir. Viruses* **2011**, *5*, 170–179. [CrossRef] [PubMed]
116. Gralton, J.; McLaws, M.-L. Protecting Healthcare Workers from Pandemic Influenza: N95 or Surgical Masks? *Crit. Care Med.* **2010**, *38*, 657–667. [CrossRef] [PubMed]
117. Smith, J.D.; MacDougall, C.C.; Johnstone, J.; Copes, R.A.; Schwartz, B.; Garber, G.E. Effectiveness of N95 Respirators versus Surgical Masks in Protecting Health Care Workers from Acute Respiratory Infection: A Systematic Review and Meta-Analysis. *CMAJ* **2016**, *188*, 567–574. [CrossRef] [PubMed]
118. Lee, S.-A.; Grinshpun, S.A.; Reponen, T. Respiratory Performance Offered by N95 Respirators and Surgical Masks: Human Subject Evaluation with NaCl Aerosol Representing Bacterial and Viral Particle Size Range. *Ann. Occup. Hyg.* **2008**, *52*, 177–185. [CrossRef] [PubMed]
119. Zhu, N.; Zhang, D.; Wang, W.; Li, X.; Yang, B.; Song, J.; Zhao, X.; Huang, B.; Shi, W.; Lu, R.; et al. A Novel Coronavirus from Patients with Pneumonia in China, 2019. *N. Engl. J. Med.* **2020**. [CrossRef]
120. Oberg, T.; Brosseau, L.M. Surgical Mask Filter and Fit Performance. *Am. J. Infect. Control* **2008**, *36*, 276–282. [CrossRef]
121. Eninger, R.M.; Honda, T.; Adhikari, A.; Heinonen-Tanski, H.; Reponen, T.; Grinshpun, S.A. Filter Performance of N99 and N95 Facepiece Respirators Against Viruses and Ultrafine Particles. *Ann. Occup. Hyg.* **2008**, *52*, 385–396. [CrossRef]
122. Morawska, L. Droplet Fate in Indoor Environments, or Can We Prevent the Spread of Infection? *Indoor Air* **2006**, *16*, 335–347. [CrossRef]
123. Ueki, H.; Furusawa, Y.; Iwatsuki-Horimoto, K.; Imai, M.; Kabata, H.; Nishimura, H.; Kawaoka, Y. Effectiveness of Face Masks in Preventing Airborne Transmission of SARS-CoV-2. *mSphere* **2020**, *5*, e00637-20. [CrossRef]
124. Radonovich, L.J.; Simberkoff, M.S.; Bessesen, M.T.; Brown, A.C.; Cummings, D.A.T.; Gaydos, C.A.; Los, J.G.; Krosche, A.E.; Gibert, C.L.; Gorse, G.J.; et al. N95 Respirators vs Medical Masks for Preventing Influenza Among Health Care Personnel: A Randomized Clinical Trial. *JAMA* **2019**, *322*, 824–833. [CrossRef]
125. Loeb, M.; Dafoe, N.; Mahony, J.; John, M.; Sarabia, A.; Glavin, V.; Webby, R.; Smieja, M.; Earn, D.J.D.; Chong, S.; et al. Surgical Mask vs N95 Respirator for Preventing Influenza Among Health Care Workers: A Randomized Trial. *JAMA* **2009**, *302*, 1865–1871. [CrossRef]
126. Konda, A.; Prakash, A.; Moss, G.A.; Schmoldt, M.; Grant, G.D.; Guha, S. Aerosol Filtration Efficiency of Common Fabrics Used in Respiratory Cloth Masks. *ACS Nano* **2020**, *14*, 6339–6347. [CrossRef]
127. Chughtai, A. Use of Cloth Masks in the Practice of Infection Control–Evidence and Policy Gaps. *Int. J. Infect. Control* **2013**, *9*. [CrossRef]
128. Labortest-Schutzmasken im Härtetest: Die Meisten Filtern Ungenügend. Available online: https://www.srf.ch/news/panorama/labortest-schutzmasken-im-haertetest-die-meisten-filtern-ungenuegend (accessed on 12 November 2020).
129. MacIntyre, C.R.; Cauchemez, S.; Dwyer, D.E.; Seale, H.; Cheung, P.; Browne, G.; Fasher, M.; Wood, J.; Gao, Z.; Booy, R.; et al. Face Mask Use and Control of Respiratory Virus Transmission in Households. *Emerg. Infect. Dis.* **2009**, *15*, 233–241. [CrossRef]
130. Xiao, J.; Shiu, E.Y.C.; Gao, H.; Wong, J.Y.; Fong, M.W.; Ryu, S.; Cowling, B.J. Nonpharmaceutical Measures for Pandemic Influenza in Nonhealthcare Settings—Personal Protective and Environmental Measures. *Emerg. Infect. Dis.* **2020**, *26*, 967–975. [CrossRef]
131. Aiello, A.E.; Murray, G.F.; Perez, V.; Coulborn, R.M.; Davis, B.M.; Uddin, M.; Shay, D.K.; Waterman, S.H.; Monto, A.S. Mask Use, Hand Hygiene, and Seasonal Influenza-like Illness among Young Adults: A Randomized Intervention Trial. *J. Infect. Dis.* **2010**, *201*, 491–498. [CrossRef]
132. Bundgaard, H.; Bundgaard, J.S.; Raaschou-Pedersen, D.E.T.; von Buchwald, C.; Todsen, T.; Norsk, J.B.; Pries-Heje, M.M.; Vissing, C.R.; Nielsen, P.B.; Winsløw, U.C.; et al. Effectiveness of Adding a Mask Recommendation to Other Public Health Measures to Prevent SARS-CoV-2 Infection in Danish Mask Wearers. *Ann. Intern. Med.* **2020**. [CrossRef]
133. Smart, N.R.; Horwell, C.J.; Smart, T.S.; Galea, K.S. Assessment of the Wearability of Facemasks against Air Pollution in Primary School-Aged Children in London. *Int. J. Environ. Res. Public Health* **2020**, *17*, 3935. [CrossRef]
134. Forgie, S.E.; Reitsma, J.; Spady, D.; Wright, B.; Stobart, K. The "Fear Factor" for Surgical Masks and Face Shields, as Perceived by Children and Their Parents. *Pediatrics* **2009**, *124*, e777–e781. [CrossRef]
135. Schwarz, S.; Jenetzky, E.; Krafft, H.; Maurer, T.; Martin, D. Corona Children Studies "Co-Ki": First Results of a Germany-Wide Registry on Mouth and Nose Covering (Mask) in Children. *Monatsschrift Kinderheilkde* **2021**, 1–10. [CrossRef]
136. Zoccal, D.B.; Furuya, W.I.; Bassi, M.; Colombari, D.S.A.; Colombari, E. The Nucleus of the Solitary Tract and the Coordination of Respiratory and Sympathetic Activities. *Front. Physiol.* **2014**, *5*, 238. [CrossRef]
137. Neilson, S. The Surgical Mask Is a Bad Fit for Risk Reduction. *CMAJ* **2016**, *188*, 606–607. [CrossRef]
138. SOCIUM Research Center on Inequality and Social Policy, Universität Bremen. Available online: https://www.socium.uni-bremen.de/ueber-das-socium/aktuelles/archiv/ (accessed on 28 January 2021).
139. Fadare, O.O.; Okoffo, E.D. Covid-19 Face Masks: A Potential Source of Microplastic Fibers in the Environment. *Sci. Total Environ.* **2020**, *737*, 140279. [CrossRef]
140. Potluri, P.; Needham, P. *Technical Textiles for Protection (Manchester EScholar-The University of Manchester)*; Woodhead Publishing: Cambridge, UK, 2005.
141. Schnurr, R.E.J.; Alboiu, V.; Chaudhary, M.; Corbett, R.A.; Quanz, M.E.; Sankar, K.; Srain, H.S.; Thavarajah, V.; Xanthos, D.; Walker, T.R. Reducing Marine Pollution from Single-Use Plastics (SUPs): A Review. *Mar. Pollut. Bull.* **2018**, *137*, 157–171. [CrossRef]

142. Reid, A.J.; Carlson, A.K.; Creed, I.F.; Eliason, E.J.; Gell, P.A.; Johnson, P.T.J.; Kidd, K.A.; MacCormack, T.J.; Olden, J.D.; Ormerod, S.J.; et al. Emerging Threats and Persistent Conservation Challenges for Freshwater Biodiversity. *Biol. Rev. Camb. Philos. Soc.* **2019**, *94*, 849–873. [CrossRef]
143. Fisher, K.A.; Tenforde, M.W.; Feldstein, L.R.; Lindsell, C.J.; Shapiro, N.I.; Files, D.C.; Gibbs, K.W.; Erickson, H.L.; Prekker, M.E.; Steingrub, J.S.; et al. Community and Close Contact Exposures Associated with COVID-19 among Symptomatic Adults ≥18 Years in 11 Outpatient Health Care Facilities-United States, July 2020. *MMWR Morb. Mortal. Wkly. Rep.* **2020**, *69*, 1258–1264. [CrossRef]
144. Belkin, N. The Evolution of the Surgical Mask: Filtering Efficiency versus Effectiveness. *Infect. Control Hosp. Epidemiol.* **1997**, *18*, 49–57. [CrossRef]
145. Cowling, B.J.; Chan, K.-H.; Fang, V.J.; Cheng, C.K.Y.; Fung, R.O.P.; Wai, W.; Sin, J.; Seto, W.H.; Yung, R.; Chu, D.W.S.; et al. Facemasks and Hand Hygiene to Prevent Influenza Transmission in Households: A Cluster Randomized Trial. *Ann. Intern. Med.* **2009**, *151*, 437–446. [CrossRef]
146. Cowling, B.J.; Zhou, Y.; Ip, D.K.M.; Leung, G.M.; Aiello, A.E. Face Masks to Prevent Transmission of Influenza Virus: A Systematic Review. *Epidemiol. Infect.* **2010**, *138*, 449–456. [CrossRef]
147. Institute of Medicine (US). Committee on Personal Protective Equipment for Healthcare Personnel to Prevent Transmission of Pandemic Influenza and Other Viral Respiratory Infections: Current Research Issues. In *Preventing Transmission of Pandemic Influenza and Other Viral Respiratory Diseases: Personal Protective Equipment for Healthcare Personnel: Update 2010*; Larson, E.L., Liverman, C.T., Eds.; National Academies Press (US): Washington, DC, USA, 2011; ISBN 978-0-309-16254-8.
148. Matuschek, C.; Moll, F.; Fangerau, H.; Fischer, J.C.; Zänker, K.; van Griensven, M.; Schneider, M.; Kindgen-Milles, D.; Knoefel, W.T.; Lichtenberg, A.; et al. The History and Value of Face Masks. *Eur. J. Med. Res.* **2020**, *25*, 23. [CrossRef] [PubMed]
149. Spooner, J.L. History of Surgical Face Masks. *AORN J.* **1967**, *5*, 76–80. [CrossRef]
150. Burgess, A.; Horii, M. Risk, Ritual and Health Responsibilisation: Japan's "safety Blanket" of Surgical Face Mask-Wearing. *Sociol. Health Illn.* **2012**, *34*, 1184–1198. [CrossRef] [PubMed]
151. Beck, U. *Risk Society, towards a New Modernity*; SAGE Publications Ltd: Thousand Oaks, CA, USA, 1992.
152. Cheng, K.K.; Lam, T.H.; Leung, C.C. Wearing Face Masks in the Community during the COVID-19 Pandemic: Altruism and Solidarity. *Lancet* **2020**. [CrossRef]
153. Melnychuk, M.C.; Dockree, P.M.; O'Connell, R.G.; Murphy, P.R.; Balsters, J.H.; Robertson, I.H. Coupling of Respiration and Attention via the Locus Coeruleus: Effects of Meditation and Pranayama. *Psychophysiology* **2018**, *55*, e13091. [CrossRef] [PubMed]
154. Andresen, M.C.; Kunze, D.L. Nucleus Tractus Solitarius–Gateway to Neural Circulatory Control. *Annu. Rev. Physiol.* **1994**, *56*, 93–116. [CrossRef] [PubMed]
155. Kline, D.D.; Ramirez-Navarro, A.; Kunze, D.L. Adaptive Depression in Synaptic Transmission in the Nucleus of the Solitary Tract after In Vivo Chronic Intermittent Hypoxia: Evidence for Homeostatic Plasticity. *J. Neurosci.* **2007**, *27*, 4663–4673. [CrossRef]
156. King, T.L.; Heesch, C.M.; Clark, C.G.; Kline, D.D.; Hasser, E.M. Hypoxia Activates Nucleus Tractus Solitarii Neurons Projecting to the Paraventricular Nucleus of the Hypothalamus. *Am. J. Physiol. Regul. Integr. Comp. Physiol.* **2012**, *302*, R1219–R1232. [CrossRef]
157. Yackle, K.; Schwarz, L.A.; Kam, K.; Sorokin, J.M.; Huguenard, J.R.; Feldman, J.L.; Luo, L.; Krasnow, M.A. Breathing Control Center Neurons That Promote Arousal in Mice. *Science* **2017**, *355*, 1411–1415. [CrossRef]
158. Menuet, C.; Connelly, A.A.; Bassi, J.K.; Melo, M.R.; Le, S.; Kamar, J.; Kumar, N.N.; McDougall, S.J.; McMullan, S.; Allen, A.M. PreBötzinger Complex Neurons Drive Respiratory Modulation of Blood Pressure and Heart Rate. *eLife* **2020**, *9*, e57288. [CrossRef]
159. Zope, S.A.; Zope, R.A. Sudarshan Kriya Yoga: Breathing for Health. *Int. J. Yoga* **2013**, *6*, 4–10. [CrossRef]
160. Cummins, E.P.; Strowitzki, M.J.; Taylor, C.T. Mechanisms and Consequences of Oxygen and Carbon Dioxide Sensing in Mammals. *Physiol. Rev.* **2020**, *100*, 463–488. [CrossRef]
161. Jafari, M.J.; Khajevandi, A.A.; Mousavi Najarkola, S.A.; Yekaninejad, M.S.; Pourhoseingholi, M.A.; Omidi, L.; Kalantary, S. Association of Sick Building Syndrome with Indoor Air Parameters. *Tanaffos* **2015**, *14*, 55–62.
162. Redlich, C.A.; Sparer, J.; Cullen, M.R. Sick-Building Syndrome. *Lancet* **1997**, *349*, 1013–1016. [CrossRef]
163. Kaw, R.; Hernandez, A.V.; Walker, E.; Aboussouan, L.; Mokhlesi, B. Determinants of Hypercapnia in Obese Patients with Obstructive Sleep Apnea: A Systematic Review and Metaanalysis of Cohort Studies. *Chest* **2009**, *136*, 787–796. [CrossRef]
164. Edwards, N.; Wilcox, I.; Polo, O.J.; Sullivan, C.E. Hypercapnic Blood Pressure Response Is Greater during the Luteal Phase of the Menstrual Cycle. *J. Appl. Physiol.* **1996**, *81*, 2142–2146. [CrossRef]
165. AAFA Community Services. What People with Asthma Need to Know about Face Masks and Coverings during the COVID-19 Pandemic. Available online: https://community.aafa.org/blog/what-people-with-asthma-need-to-know-about-face-masks-and-coverings-during-the-covid-19-pandemic (accessed on 29 January 2021).
166. Shigemura, M.; Lecuona, E.; Angulo, M.; Homma, T.; Rodríguez, D.A.; Gonzalez-Gonzalez, F.J.; Welch, L.C.; Amarelle, L.; Kim, S.-J.; Kaminski, N.; et al. Hypercapnia Increases Airway Smooth Muscle Contractility via Caspase-7-Mediated MiR-133a-RhoA Signaling. *Sci. Transl. Med.* **2018**, *10*, eaat1662. [CrossRef]
167. Roberge, R. Facemask Use by Children during Infectious Disease Outbreaks. *Biosecur. Bioterror.* **2011**, *9*, 225–231. [CrossRef]
168. Schwarz, S.; Jenetzky, E.; Krafft, H.; Maurer, T.; Steuber, C.; Reckert, T.; Fischbach, T.; Martin, D. Corona bei Kindern: Die Co-Ki Studie. *Mon. Kinderheilkde* **2020**. [CrossRef]
169. van der Kleij, L.A.; De Vis, J.B.; de Bresser, J.; Hendrikse, J.; Siero, J.C.W. Arterial CO_2 Pressure Changes during Hypercapnia Are Associated with Changes in Brain Parenchymal Volume. *Eur. Radiol. Exp.* **2020**, *4*, 17. [CrossRef]

170. Geer Wallace, M.A.; Pleil, J.D. Evolution of Clinical and Environmental Health Applications of Exhaled Breath Research: Review of Methods: Instrumentation for Gas-Phase, Condensate, and Aerosols. *Anal. Chim. Acta* **2018**, *1024*, 18–38. [CrossRef] [PubMed]
171. Sukul, P.; Schubert, J.K.; Zanaty, K.; Trefz, P.; Sinha, A.; Kamysek, S.; Miekisch, W. Exhaled Breath Compositions under Varying Respiratory Rhythms Reflects Ventilatory Variations: Translating Breathomics towards Respiratory Medicine. *Sci. Rep.* **2020**, *10*, 14109. [CrossRef] [PubMed]
172. Lai, P.S.; Christiani, D.C. Long-Term Respiratory Health Effects in Textile Workers. *Curr. Opin. Pulm. Med.* **2013**, *19*, 152–157. [CrossRef] [PubMed]
173. Goetz, L.H.; Schork, N.J. Personalized Medicine: Motivation, Challenges and Progress. *Fertil. Steril.* **2018**, *109*, 952–963. [CrossRef]
174. Samannan, R.; Holt, G.; Calderon-Candelario, R.; Mirsaeidi, M.; Campos, M. Effect of Face Masks on Gas Exchange in Healthy Persons and Patients with COPD. *Ann. ATS* **2020**. [CrossRef]
175. Streeck, H.; Schulte, B.; Kuemmerer, B.; Richter, E.; Hoeller, T.; Fuhrmann, C.; Bartok, E.; Dolscheid, R.; Berger, M.; Wessendorf, L.; et al. Infection Fatality Rate of SARS-CoV-2 Infection in a German Community with a Super-Spreading Event. *medRxiv* **2020**. [CrossRef]
176. Ioannidis, J. The Infection Fatality Rate of COVID-19 Inferred from Seroprevalence Data. *medRxiv* **2020**. [CrossRef]
177. Executive Board: Special Session on the COVID-19 Response. Available online: https://www.who.int/news-room/events/detail/2020/10/05/default-calendar/executive-board-special-session-on-the-covid19-response (accessed on 13 November 2020).
178. International Health Conference. WHO-Constitution of the World Health Organization. 1946. *Bull. World Health Organ.* **2002**, *80*, 983–984.

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Abstract

Background: Deformity in the dental arc and facial skeleton by adenoid hypertrophy due to chronic mouth breathing is a well-known process. Most of the related studies have been based on cephalometric analyses. The aim of this study is to detect the presence of skeletal deformities on the soft tissue by analyzing distances and angles on photographs.

Methods: Ninety-seven children having between 25 and 100 % of adenoids, ages 4-12 years (48 boys, 49 girls), and 90 cases having 0-25 % adenoid tissue, ages 4-12 years (54 boys, 36 girls), were studied by clinical history, physical examination (including endoscopy), and standardized clinical photographs. The children and parents were asked if any of the following were present in the children: snoring, sleep apnea, daytime sleepiness, poor school performance, mouth breathing during sleep, smoking parents, and restlessness during sleep.

Results: The assessment of linear and angular measurements on the clinical photographs showed, in the group having thicker adenoids compared with controls, a statistically significant increase in the distance between nasion and tip and nasion

and subnasale and in the angle between Frankfort horizontal plane-gnathion-angulus mandible; there was also a statistically significant decrease in the distance between endocanthion and exocanthion and the angles between tragion-angulus mandible and gnathion and between nasion-angulus mandible and gnathion.

Conclusions: The analyses showed a significant increase in the anterior face height and increase in the angle between Frankfort horizontal plane-gnathion-angulus mandible and a retropositioned and posterior-rotated mandible due to thicker adenoids.

Trial registration: 2010/140 Date: 04 January 2010.

Keywords: Adenoid hypertrophy; Facial morphology; Mouth breathing; Photographic analysis.

Figures

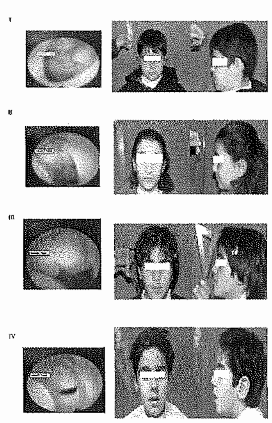

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Fig. 2 Facial-analyzing points. V:Vertex, Tr:Trichion, G:Glabella,...

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References

1. Çelik O, Yalçın Ş, İnan E, Kaygusuz İ, Yanık H. Adenoid hipertrofisinin maksillofasial gelişim üzerine etkileri. K.B.B. ve Baş Boyun Cerrahisi

Dergisi. 1995;3:222-6.
2. Arsalah R, Waheed H, Fatima J. Cephalometric assessment of patients with adenoidal faces. J Pak Med Assoc. 2009;59:747–52. - PubMed
3. Peltomaki T. The effect of mode of breathing on craniofacial growth. Eur J Orthod. 2007;29:426–9. doi: 10.1093/ejo/cjm055. - DOI - PubMed
4. Erdem T, Ozturan O. Objective measurement of the deviated nose and a review of surgical techniques for correction. Rhinology. 2008;46:56–61. - PubMed
5. Erdem T. Long-term effectiveness of projection control suture in rhinoplasty. Rhinology. 2010;48:89–94. - PubMed

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"AMBITIOUS AND GROUNDBREAKING" CDC STUDY FINDS "NULL EFFECTS" OF MASK MANDATES IN SCHOOLS

A May 2021 Study From The CDC Found That Incidence Of COVID-19 For Students In Schools Mandating Masks "Was Not Statistically Significant Compared With Schools Where Mask Use Was Optional." "The 21% lower incidence in schools that required mask use among students was not statistically significant compared with schools where mask use was optional. This finding might be attributed to higher effectiveness of masks among adults, who are at higher risk for SARS-CoV-2 infection but might also result from differences in mask-wearing behavior among students in schools with optional requirements." (Jenna Gettings, DVM; Michaila Czarnik, MPH; Elana Morris, MPH; Elizabeth Haller, MEd; Angela M. Thompson-Paul, PhD; Catherine Rasberry, PhD; Tatiana M. Lanzieri, MD; Jennifer Smith-Grant, MSPH; Tiffiany Michelle Aholou, PhD; Ebony Thomas, MPH; Cherie Drenzek, DVM; Duncan MacKellar, DrPH; "Mask Use and Ventilation Improvements to Reduce COVID-19 Incidence in Elementary Schools — Georgia, November 16-December 11, 2020," U.S. Centers for Disease Control and Prevention's Morbidity and Mortality Weekly Report, 5/21/21)

- **The CDC's "Ambitious And Groundbreaking" Study Covered More Than 90,000 Georgia Students Who Attended 169 Schools, Some With Mask Mandates And Some Without.** "The study published by the CDC was both ambitious and groundbreaking. It covered more than 90,000 elementary-school students in 169 Georgia schools from November 16 to December 11 and was, according to the CDC, the first of its kind to compare COVID-19 incidence in schools with certain mitigation measures in place to other schools without those measures." (David Zweig, "The Science of Masking Kids at School Remains Uncertain," *New York Magazine's Intelligencer*, 8/20/21)

Scientists: CDC's Omission of Findings "Amounted to 'File Drawering'"

Scientists Accused The CDC of Burying The Study's Finding Of "Null Effects Of A Student Masking Requirement" By Leaving It Out Of The Study's Summary. "Scientists I spoke with believe that the decision not to include the null effects of a student masking requirement (and distancing, hybrid models, etc.) in the summary amounted to 'file drawering' these findings, a term researchers use for the practice of burying studies that don't produce statistically significant results." (David Zweig, "The Science of Masking Kids at School Remains Uncertain," *New York Magazine's Intelligencer*, 8/20/21)

Exhibit AE

- **Vinay Prasad, Associate Professor In University Of California, San Francisco's Department Of Epidemiology And Biostatistics: "It Should Have Been Included In The Summary."** "'That a masking requirement of students failed to show independent benefit is a finding of consequence and great interest,' says Vinay Prasad, an associate professor in University of California, San Francisco's Department of Epidemiology and Biostatistics. 'It should have been included in the summary.'" (David Zweig, "The Science of Masking Kids at School Remains Uncertain," *New York Magazine's Intelligencer*, 8/20/21)

- **Tracy Hoeg, An Epidemiologist And Associate Researcher At The University Of California, Davis: "The Summary Gives The Impression That Only Masking Of Staff Was Studied, When In Reality There Was This Additional Important Detection About A Student-Masking Requirement Not Having A Statistical Impact."** "'The summary gives the impression that only masking of staff was studied,' says Tracy Hoeg, an epidemiologist and the senior author of a separate CDC study on COVID-19 transmission in schools, 'when in reality there was this additional important detection about a student-masking requirement not having a statistical impact.'" (David Zweig, "The Science of Masking Kids at School Remains Uncertain," *New York Magazine's Intelligencer*, 8/20/21)

About Two Months Later, The CDC Ignores Its Own Study, Recommends "Universal Indoor Masking" In Schools

The CDC Recommends "Universal Indoor Masking" For Students In School. "CDC recommends universal indoor masking for all teachers, staff, students, and visitors to K-12 schools, regardless of vaccination status." ("Guidance for COVID-19 Prevention in K-12 Schools," U.S. Centers for Disease Control and Prevention, 8/5/21, Accessed 8/30/21)

The American Academy Of Pediatrics Issued Guidance In July That "All Students Older Than 2 Years Old…Should Wear Face Masks At School." "All students older than 2 years and all school staff should wear face masks at school (unless medical or developmental conditions prohibit use)." ("COVID-19 Guidance for Safe Schools," American Academy of Pediatrics, Accessed 8/30/21)

While AAP, CDC Use Silence And Misdirection When Pressed On Recommendations, "Many Experts" More Open And Direct

In Response To A Reporter's Request For "Underlying Data" To Support Their Recommendation For Universal Masking In Schools, AAP "Did Not Respond" And The CDC "Links To Unrelated Materials On Vaccines And A Recent Outbreak Among Adults." "After the CDC and the American Academy of Pediatrics issued their student-mask guidance last month, I contacted both organizations asking for the evidence or underlying data upon which they had based their recommendations. The AAP did not respond to multiple requests. The CDC press office replied that since children under 12 cannot be vaccinated, the agency 'recommends schools do universal masking' and included links to unrelated materials on vaccines and a recent outbreak

among adults." (David Zweig, "The Science of Masking Kids at School Remains Uncertain," New York Magazine's Intelligencer, 8/20/21)

After Consulting "Many Experts," "Nobody Was Able To Find A Data Set As Robust As The Georgia Results — That Is, A Large Cohort Study Directly Looking At The Effects Of A Mask Requirement." "Over the course of several weeks, I also corresponded with many experts — epidemiologists, infectious-disease specialists, an immunologist, pediatricians, and a physician publicly active in matters relating to COVID — asking for the best evidence they were aware of that mask requirements on students were effective. Nobody was able to find a data set as robust as the Georgia results — that is, a large cohort study directly looking at the effects of a mask requirement." (David Zweig, "The Science of Masking Kids at School Remains Uncertain," New York Magazine's Intelligencer, 8/20/21)

SCIENTISTS, DOCTORS, RESEARCHERS FIND "NO SCIENCE BEHIND MASK MANDATES FOR CHILDREN"

Dr. Marty Makary And Dr. H. Cody Meissner: "There's No Science Behind Mask Mandates For Children." "We have been encouraging Americans to wear masks since the beginning of the pandemic. But special attention should be paid to the many children who struggle with masks. Public-health officials claim to base their decisions and guidance on science, but there's no science behind mask mandates for children." (Marty Makary and H. Cody Meissner, "The Case Against Masks for Children," The Wall Street Journal, 8/8/21)

- **Dr. Marty Makary Is A Professor At Johns Hopkins School Of Medicine.** (Profile of Martin Adel Makary, M.D., M.P.H., Johns Hopkins Medicine website, Accessed 8/30/21)

- **Dr. H. Cody Meissner Is Chief Of Pediatric Infectious Disease At Tufts Children's Hospital And A Professor Of Pediatrics At Tufts University School Of Medicine.** (Profile of H. Cody Meissner, M.D., Tufts Children's Hospital Website, Accessed 8/30/21)

Dr. Vinay Prasad, M.D., M.P.H., And Associate Professor Of Medicine At The University Of California San Francisco: "The CDC Cannot 'Follow The Science' Because There Is No Relevant Science." "The CDC cannot 'follow the science' because there is no relevant science. The proposition is at best science-y; a best guess based on political pressure, pundit anxiety, and mechanistic understanding." (Vinay Prasad, "What's the Evidence Guiding CDC's Latest Mask Policy?" Medpage Today, 7/29/21)

- **Dr. Prasad: "We Have Learned Next To Nothing" About The Efficacy Of Mask Mandates.** "When it comes to non-pharmacologic interventions such as mandatory business closures, mask mandates, and countless other interventions, the shocking conclusion of the last 18 months is this: We have learned next to nothing. Yet, here we are again with CDC changing its mind on masking, but what new evidence is guiding the policy?" (Vinay Prasad, "What's the Evidence Guiding CDC's Latest Mask Policy?" Medpage Today, 7/29/21)

Dr. Martin Kulldorff, Professor Of Medicine At Harvard Medical School: "No Scientific Evidence That Masking Children Is Effective." "Triple stumble by Fauci[:]

1. No scientific evidence that masking children is effective[;] 2. Even if effective, children have low disease risk, minuscule mortality risk and do not transmit much[;] 3. For the rare transmission, adults should get vaccinated; not demand masks on children https://twitter.com/tomselliott/status/1415006074483118085" (Martin Kulldorff, Twitter, 7/13/21)

- **Dr. Kulldorff: "Mandating Children To Wear Masks Is Detrimental To Their Health, And Claimed Benefits To Public Health Lack Scientific Evidence."** "Anthony Fauci is an immunologist, not an infectious disease epidemiologist, but happy to debate him. Mandating children to wear masks is detrimental to their health, and claimed benefits to public health lack scientific evidence. https://twitter.com/MartinKulldorff/status/1380902063136251904" (Martin Kulldorff, Twitter, 4/11/21)

Dr. Scott Balsitis, Ph.D., Viral Immunologist, And Former CDC Fellow: "No Data" To Support Universal Indoor Masking For Students. "True, in spite of having no data showing it works. Therein lies the problem. It doesn't matter how many people want something to be true, it matters if it is true. That's why most medical experts in many other countries are recommending against masking kids." (Scott J. Balsitis, Twitter, 8/27/21)

- **Dr. Balsitis: "We Now Have Three Studies On Masking Kids, And None Show A Significant Benefit."** "We now have three studies on masking kids, and none show a significant benefit. https://www.cdc.gov/mmwr/volumes/70/wr/mm7021e1.htm https://www.medrxiv.org/content/10.1101/2021.05.19.21257467v1.full https://meridian.allenpress.com/jat/article/doi/10.4085/1062-6050-0185.21/466422/Reported-COVID-19-Incidence-in-Wisconsin-High" (Scott J. Balsitis, Twitter, 8/26/21)

Dr. Lucy M. McBride, M.D. And Practicing Internist: "The Science Simply Isn't There To Support A Mandate" Of Masks In Schools. "In my opinion, we should not have mask mandates in schools, given that kids are at exceedingly low risk of complications from Covid-19, and more importantly the science simply isn't there to support a mandate." (Fiona Rutherford, "Schools Get CDC Leeway on Covid Limits to Keep Kids in Class," *Bloomberg*, 7/9/21)

- **Dr. McBride: "I Take Issue W/ Mask Mandates In Schools When The Science Isn't There."** "I take issue w/ mask mandates in schools when the science isn't there. IMHO the decision to mask should be up to the family, child, & peds MD based on the unique child/family medical/social/environm factors. Ex. a high-risk child or a child living w/ non-immune family might mask." (Lucy McBride, MD, Twitter, 7/9/21)

- **Dr. McBride: "There Isn't Any Solid Evidence That Masking Children Helps Reduce Covid Transmission. We Just Don't Have That Data."** (Fiona Rutherford, "Schools Get CDC Leeway on Covid Limits to Keep Kids in Class," *Bloomberg*, 7/9/21)

Dr. Elissa Schechter-Perkins, M.D., M.P.H.: "I'm Not Aware Of Any Studies That Show Conclusively That Kids Wearing Masks In Schools Has Any Effect On Their

Own Morbidity Or Mortality Or On The Hospitalization Or Death Rate In The Community Around Them." "'A year ago, I said, 'Masks are not the end of the world; why not just wear a mask?'' Elissa Schechter-Perkins, the director of Emergency Medicine Infectious Disease Management at Boston Medical Center, told me. 'But the world has changed, there are real downsides to masking children for this long, with no known end date, and without any clear upside.' She continued, 'I'm not aware of any studies that show conclusively that kids wearing masks in schools has any effect on their own morbidity or mortality or on the hospitalization or death rate in the community around them.'" (David Zweig, "The Science of Masking Kids at School Remains Uncertain," *New York Magazine's Intelligencer*, 8/20/21)

- **Dr. Elissa Schechter-Perkins Is An Associate Professor Of Emergency Medicine At The Boston University School Of Medicine And The Director Of Emergency Medicine Infectious Disease Management At Boston Medical Center.** (Profile of Elissa M. Schechter-Perkins, MD, MPH, BU School of Medicine website, Accessed 8/30/21; David Zweig, "The Science of Masking Kids at School Remains Uncertain," *New York Magazine's Intelligencer*, 8/20/21)

Dr. Jeffrey Flier, M.D., Former Dean Of The Faculty Of Medicine At Harvard University: "We Lack Credible Evidence For Benefits Of Masking Kids Aged 2-5." "We lack credible evidence for benefits of masking kids aged 2-5. Despite what American Academy of Pediatrics says. @VPrasadMDMPH explains. https://twitter.com/VPrasadMDMPH/status/1417199553762119682" (Jeffrey Flier, Twitter, 7/19/21)

Study About Whether Masks Reduce Covid Transmission In Children Was "Inconclusive." "Do masks reduce Covid transmission in children? Believe it or not, we could find only a single retrospective study on the question, and its results were inconclusive." (Marty Makary and H. Cody Meissner, "The Case Against Masks for Children," *The Wall Street Journal*, 8/8/21)

Researchers And Doctors In Germany Conclude That "There Is A Lack Of Evidence For Widespread Use [Of Masks] In Children." "The effectiveness of masks in children as a viral protection is controversial, and there is a lack of evidence for their widespread use in children; this is also addressed in more detail by the scientists of the German University of Bremen in their thesis paper 2.0 and 3.0." (Kai Kisielinski, Paul Giboni, Andreas Prescher, Bernd Klosterhalfen, David Graessel, Stefan Funken, Oliver Kempski, and Oliver Hirsch, "Is a Mask That Covers the Mouth and Nose Free from Undesirable Side Effects in Everyday Use and Free of Potential Hazards?" *International Journal of Environmental Research and Public Health*, 4/21, 18(8): 4344)

- **Researchers And Doctors In Germany: "Further Research Is Particularly Desirable."** "For scientists, the prospect of continued mask use in everyday life suggests areas for further research. In our view, further research is particularly desirable in the gynecological (fetal and embryonic) and pediatric fields, as children are a vulnerable group that would face the longest and, thus, most profound consequences of a potentially risky mask use." (Kai Kisielinski, Paul Giboni, Andreas Prescher, Bernd Klosterhalfen, David Graessel, Stefan Funken, Oliver Kempski, and Oliver Hirsch, "Is a Mask That Covers the Mouth and Nose Free from Undesirable Side Effects in Everyday Use and Free of Potential Hazards?" *International Journal of Environmental Research and Public Health*, 4/21, 18(8): 4344)

Experts Indicate Mandating Masks In Schools "May Contribute Only A Marginal Benefit Or None At All." "Though the CDC says that layered mitigation in schools is effective, without studying each of the layers individually, it cannot know which of those measures work, and to what degree, and which don't. For example, several experts told me, it's entirely possible that open windows or fresh-air ventilation accounts for nearly all the mitigation benefit in a classroom and other 'layered' interventions may contribute only a marginal benefit or none at all." (David Zweig, "The Science of Masking Kids at School Remains Uncertain," *New York Magazine's Intelligencer*, 8/20/21)

Brown University Researchers Did "Not Find Any Correlations With Mask Mandates" And COVID-19 Case Rates Among Students. "This paper reports on the correlation of mitigation practices with staff and student COVID-19 case rates in Florida, New York, and Massachusetts during the 2020-2021 school year. We analyze data collected by the COVID-19 School Response Dashboard and focus on student density, ventilation upgrades, and masking. We find higher student COVID-19 rates in schools and districts with lower in-person density but no correlations in staff rates. Ventilation upgrades are correlated with lower rates in Florida but not in New York. We do not find any correlations with mask mandates. All rates are lower in the spring, after teacher vaccination is underway." (Emily Oster, Rebecca Jack, Clare Halloran, John Schoof, Diana McLeod, "COVID-19 Mitigation Practices and COVID-19 Rates in Schools: Report on Data from Florida, New York and Massachusetts," medRxiv, 5/21/21)

World Health Organization: Studies On Effectiveness Of Masking Students In School Are "Sparse." "Studies on the effects of risk-mitigation interventions in schools, such as limiting contact between children, wearing masks (outside or in classes continuously), closing areas and activities (play, sports, canteens) and enhancing ventilation, are sparse." (World Health Organization, "Schooling during COVID-19: recommendations from the European Technical Advisory Group for schooling during COVID-19," WHO Regional Office for Europe, 6/21)

But CDC Recommendations, News Headlines Ignore "Lack Of Evidence" On Masking Kids In School

"The Best Practices For Mask Use In Schools…Are Much Less Obvious Than CDC Guidance And News Headlines About Keeping Schools Safe Might Have You Believe." "But with tens of millions of American kids headed back to school in the fall, their parents and political leaders owe it to them to have a clear-sighted, scientifically rigorous discussion about which anti-COVID measures actually work and which might put an extra burden on vulnerable young people without meaningfully or demonstrably slowing the spread of the virus. In that context, the best practices for mask use in schools — elementary schools in particular — are much less obvious than CDC guidance and news headlines about keeping schools safe might have you believe." (David Zweig, "The Science of Masking Kids at School Remains Uncertain," *New York Magazine's Intelligencer*, 8/20/21)

SCIENTISTS, DOCTORS, RESEARCHERS FIND NEGATIVE IMPACTS OF MASKING CHILDREN

Experts Find Children Can Face "Psychological Harm" From Wearing Masks

Children Can Face "Psychological Harm" From Masking, Including "Robotic And Emotionless Interactions, Anxiety And Depression," According To Professors Of Medicine At Johns Hopkins University And Tufts University. "The possible psychological harm of widespread masking is an even greater worry. Facial expressions are integral to human connection, particularly for young children, who are only learning how to signal fear, confusion and happiness. Covering a child's face mutes these nonverbal forms of communication and can result in robotic and emotionless interactions, anxiety and depression. Seeing people speak is a building block of phonetic development. It is especially important for children with disabilities such as hearing impairment." (Marty Makary and H. Cody Meissner, "The Case Against Masks for Children," *The Wall Street Journal*, 8/8/21)

Mask Mandates In Schools Can Impact The "Psychological And Physical Development Of Healthy Children." "The long-term sociological, psychological and educational consequences of a comprehensive masking requirement extended to schools are also unpredictable with regard to the psychological and physical development of healthy children." (Kai Kisielinski, Paul Giboni, Andreas Prescher, Bernd Klosterhalfen, David Graessel, Stefan Funken, Oliver Kempski, and Oliver Hirsch, "Is a Mask That Covers the Mouth and Nose Free from Undesirable Side Effects in Everyday Use and Free of Potential Hazards?" *International Journal of Environmental Research and Public Health*, 4/21, 18(8): 4344)

Mask-Wearing Children May Face "Panic Attacks" And "Claustrophobic Fears." "In the field of pediatrics, special attention should also be paid to the mask symptoms described under psychological, psychiatric and sociological effects with possible triggering of panic attacks by CO2 rebreathing in the case of predisposition and also reinforcement of claustrophobic fears." (Kai Kisielinski, Paul Giboni, Andreas Prescher, Bernd Klosterhalfen, David Graessel, Stefan Funken, Oliver Kempski, and Oliver Hirsch, "Is a Mask That Covers the Mouth and Nose Free from Undesirable Side Effects in Everyday Use and Free of Potential Hazards?" *International Journal of Environmental Research and Public Health*, 4/21, 18(8): 4344)

Children Experience Difficulty Concentrating, Joylessness, Learning Difficulties, Fatigue, Stress, And Nightmares As A Result Of Mask Wearing, According To Researchers in Germany. "A recent observational study of tens of thousands of mask-wearing children in Germany helped the investigators objectify complaints of headaches (53%), difficulty concentrating (50%), joylessness (49%), learning difficulties (38%) and fatigue in 37% of the 25,930 children evaluated. Of the children observed, 25% had new onset anxiety and even nightmares. In children, the threat scenarios generated by the environment are further maintained via masks, in some cases, even further intensified, and in this way, existing stress is intensified (presence of subconscious fears). This can in turn lead to an increase in psychosomatic and stress-related illnesses." (Kai Kisielinski, Paul Giboni, Andreas Prescher, Bernd Klosterhalfen, David Graessel, Stefan Funken, Oliver Kempski, and Oliver Hirsch, "Is a Mask That Covers the Mouth and Nose Free from Undesirable Side Effects in Everyday Use and Free of Potential Hazards?" *International Journal of Environmental Research and Public Health*, 4/21, 18(8): 4344)

- **In The Study, Mask-Wearing Children Showed High Stress Levels, With 60% At The Highest Possible Level.** "For example, according to an evaluation, 60% of mask wearers showed stress levels of the highest grade 10 on a scale of 1 to a maximum of 10. Less than 10% of the mask wearers surveyed had a stress level lower than 8 out of a possible 10." (Kai Kisielinski, Paul Giboni, Andreas Prescher, Bernd Klosterhalfen, David Graessel, Stefan Funken, Oliver Kempski, and Oliver Hirsch, "Is a Mask That Covers the

Mouth and Nose Free from Undesirable Side Effects in Everyday Use and Free of Potential Hazards?" *International Journal of Environmental Research and Public Health*, 4/21, 18(8): 4344)

- **Masks "Caused Fear In 46% Of Children" In One Scientific Study.** "Both masks and face shields caused fear in 46% of children (37 out of 80) in a scientific study. If children are given the choice of whether the doctor examining them should wear a mask they reject this in 49% of the cases. Along with their parents, the children prefer the practitioner to wear a face visor (statistically significant with $p < 0.0001$)." (Kai Kisielinski, Paul Giboni, Andreas Prescher, Bernd Klosterhalfen, David Graessel, Stefan Funken, Oliver Kempski, and Oliver Hirsch, "Is a Mask That Covers the Mouth and Nose Free from Undesirable Side Effects in Everyday Use and Free of Potential Hazards?" *International Journal of Environmental Research and Public Health*, 4/21, 18(8): 4344)

A Pediatric Immunologist Cites "Obvious Socio-Emotional And Educational Harms From Masking Children For This Unprecedented Duration Of Time." "The pediatric immunologist said, 'Even with a new variant, the onus is on those who recommend masking kids to robustly demonstrate a meaningful benefit, especially when the pre-Delta study of the Georgia schools did not find one, and when there are obvious socio-emotional and educational harms from masking children for this unprecedented duration of time.'" (David Zweig, "The Science of Masking Kids at School Remains Uncertain," *New York Magazine's Intelligencer*, 8/20/21)

Experts Find Children Can Face Developmental Setbacks From Wearing Masks

Masking's Impact On "Social Interaction Is Particularly Serious For Children." "The mask-related disturbance of verbal and non-verbal communication and, thus, of social interaction is particularly serious for children. Masks restrict social interaction and block positive perceptions (smiling and laughing) and emotional mimicry." (Kai Kisielinski, Paul Giboni, Andreas Prescher, Bernd Klosterhalfen, David Graessel, Stefan Funken, Oliver Kempski, and Oliver Hirsch, "Is a Mask That Covers the Mouth and Nose Free from Undesirable Side Effects in Everyday Use and Free of Potential Hazards?" *International Journal of Environmental Research and Public Health*, 4/21, 18(8): 4344)

Dr. Lloyd Fisher, President Of The Massachusetts Chapter Of The American Academy Of Pediatrics: "It Is Important For Children To See Facial Expressions Of Their Peers And The Adults Around Them In Order To Learn Social Cues And Understand How To Read Emotions." "'Mask-wearing among children is generally considered a low-risk mitigation strategy; however, the negatives are not zero, especially for young children,' said Lloyd Fisher, the president of the Massachusetts chapter of the American Academy of Pediatrics. 'It is important for children to see facial expressions of their peers and the adults around them in order to learn social cues and understand how to read emotions.' Some children with special needs, for example those with articulation delays, may be most affected, he suggested." (David Zweig, "The Science of Masking Kids at School Remains Uncertain," *New York Magazine's Intelligencer*, 8/20/21)

A Leader With The American Academy Of Pediatrics Said, "There Very Good Reasons" Not To Mask Children, Including For Their "Social Emotional Learning." "'There are very good reasons that the World Health Organization has repeatedly affirmed their guidance for children under 6 to not wear masks,' said a pediatrician who has both state and national leadership roles in the AAP but who wished to remain anonymous because they did not want to jeopardize their roles in the organization.

'Reading faces is critical for social emotional learning. And all children are actively learning language the first five years of life, for which seeing faces is foundational,' the pediatrician said." (David Zweig, "The Science of Masking Kids at School Remains Uncertain," *New York Magazine's Intelligencer*, 8/20/21)

Experts Find Children Can Face Medical Complications From Wearing Masks

Mask-Wearing Children Can Face "Increased Carbon Dioxide Levels In The Blood," Exposure To Pathogens, Skin Problems, And Distractions From Learning. "Those who have myopia can have difficulty seeing because the mask fogs their glasses. (This has long been a problem for medical students in the operating room.) Masks can cause severe acne and other skin problems. The discomfort of a mask distracts some children from learning. By increasing airway resistance during exhalation, masks can lead to increased levels of carbon dioxide in the blood. And masks can be vectors for pathogens if they become moist or are used for too long." (Marty Makary and H. Cody Meissner, "The Case Against Masks for Children," *The Wall Street Journal*, 8/8/21)

Children Wearing Masks "Can Develop A Mouth Deformity And Elongated Face." "Some children compensate for such difficulties by breathing through their mouths. Chronic and prolonged mouth breathing can alter facial development. It is well-documented that children who mouth-breathe because adenoids block their nasal airways can develop a mouth deformity and elongated face." (Marty Makary and H. Cody Meissner, "The Case Against Masks for Children," *The Wall Street Journal*, 8/8/21)

THE CDC IGNORES THE LACK OF EVIDENCE ON MASK MANDATES FOR STUDENTS, BUT OTHER COUNTRIES DON'T

Many European Nations "Have Exempted Kids…From Wearing Masks In Classrooms" With "No Evidence Of More Outbreaks In Schools In Those Countries Relative To Schools In The U.S." "In the realm of science and public-health policy outside the U.S., the implications of these particular findings are not exactly controversial. Many of America's peer nations around the world — including the U.K., Ireland, all of Scandinavia, France, the Netherlands, Switzerland, and Italy — have exempted kids, with varying age cutoffs, from wearing masks in classrooms. Conspicuously, there's no evidence of more outbreaks in schools in those countries relative to schools in the U.S., where the solid majority of kids wore masks for an entire academic year and will continue to do so for the foreseeable future." (David Zweig, "The Science of Masking Kids at School Remains Uncertain," *New York Magazine's Intelligencer*, 8/20/21)

In The United Kingdom, The Department For Education Advised In August 2021 That "Face Coverings Are No Longer Advised For Pupils." "Face coverings are no longer advised for pupils, staff and visitors either in classrooms or in communal areas." ("Schools COVID-19 operational guidance," U.K. Department for Education, 8/27/21)

- **The Department For Education Guidance Was Directed Toward School Leaders And Staff In Primary And Secondary Schools, Among Others.** "This guidance explains the actions school leaders should take to reduce the risk of transmission of coronavirus (COVID-19) in their school. This includes public

health advice, endorsed by Public Health England (PHE). It is for leaders and staff in: primary schools; secondary schools (including sixth forms); special schools, special post-16 providers and alternative provision; 16 to 19 academies; infant, junior, middle, upper schools; [and] boarding schools. We expect independent schools to follow the control measures set out in this guidance in the same way as state-funded schools, and health and safety legislation applies equally to independent schools." ("Schools COVID-19 operational guidance," U.K. Department for Education, 8/27/21)

Norwegian Public Health Officials "Do Not Recommend The Use Of Face Masks By Children." "We do not recommend the use of face masks by children. Children may have difficulty wearing a face mask correctly, and very young children may find it difficult to breathe well when wearing a face mask." ("Use of face masks in schools and childcare centres," Norwegian Institute of Public Health, 8/14/20)

- **Further, Norwegian Public Health Officials "Do Not Recommend The Use Of Face Masks In Schools."** "We do not recommend the use of face masks in schools. This applies to both students and staff in primary school, secondary school and upper secondary school. The same applies to children and staff in childcare centres." ("Use of face masks in schools and childcare centres," Norwegian Institute of Public Health, 8/14/20)

- **Norwegian Institute Of Public Health: "Transmission In Schools And Childcare Centres Contributes Only To A Small Extent In The Spread Of COVID-19 In The Society."** ("Advice and information for children and adolescents," Norwegian Institute of Public Health, 8/19/21)

In Sweden, "Classes Have Been Compulsory For All Pupils Up To The Age Of 16, With No Mandatory Face Masks For Pupils Or Teachers." "The country's public health authorities made the decision to keep schools open at the start of the outbreak and they stuck by this even when the death rate was ten times higher than in Sweden's Nordic neighbours. Classes have been compulsory for all pupils up to the age of 16, with no mandatory face masks for pupils or teachers." ("Sweden has kept schools open during the pandemic despite spike in cases," France 24, 9/17/20)

- **Sweden, Which Has No Mask Mandates In Schools For Students Under 16 Years Old, Had "Zero COVID Deaths Among Its 1.8M Children During First Wave."** "With open schools and no masks for ages 1-15 in Sweden, there were zero COVID deaths among its 1.8M children during first wave. Teachers had lower risk than average of other professions. So, we knew early on that schools are safe without masks." (Jonas F. Ludvigsson, M.D., Ph.D., Lars Engerström, M.D., Ph.D., Charlotta Nordenhäll, M.D., Ph.D., and Emma Larsson, M.D., Ph.D., "Open Schools, Covid-19, and Child and Teacher Morbidity in Sweden," *The New England Journal of Medicine*, 1/6/21, 384:669-671)

Ireland does not require masks in schools. "In March, Ireland's Department of Health announced that it won't require masks in schools because they 'may exacerbate anxiety or breathing difficulties for some students.'" (Marty Makary and H. Cody Meissner, "The Case Against Masks for Children," *The Wall Street Journal*, 8/8/21)

The World Health Organization "Differs Substantially" From The CDC By Not Recommending Universal Masking For Kids Under 12 Years Of Age

The World Health Organization Advises That "Children Aged 5 Years And Under Should Not Be Required To Wear Masks." "In general, children aged 5 years and under should not be required to wear masks. This advice is based on the safety and overall interest of the child and the capacity to appropriately use a mask with minimal assistance." (World Health Organization, "Coronavirus disease (COVID-19): Children and masks," World Health Organization website, 8/21/20)

- **The World Health Organization And UNICEF Recommend Masks For Children Aged 6-11 Only Under Certain Circumstances.** "WHO and UNICEF advise that the decision to use masks for children aged 6-11 should be based on the following factors: Whether there is widespread transmission in the area where the child resides[;] The ability of the child to safely and appropriately use a mask[;] Access to masks, as well as laundering and replacement of masks in certain settings (such as schools and childcare services)[;] Adequate adult supervision and instructions to the child on how to put on, take off and safely wear masks[;] Potential impact of wearing a mask on learning and psychosocial development, in consultation with teachers, parents/caregivers and/or medical providers[;] Specific settings and interactions the child has with other people who are at high risk of developing serious illness, such as the elderly and those with other underlying health conditions." (World Health Organization, "Coronavirus disease (COVID-19): Children and masks," World Health Organization website, 8/21/20)

The World Health Organization's Guidance On Masking Children "Differs Substantially From The CDC's Recommendations." "These countries, along with the World Health Organization, whose child-masking guidance differs substantially from the CDC's recommendations, have explicitly recognized that the decision to mask students carries with it potential academic and social harms for children and may lack a clear benefit. To date, the highly transmissible Delta variant has not led them to change this calculus. (Many experts I spoke with told me that while the Delta variant represents a major and concerning new development in the Covid pandemic, it probably shouldn't change our thinking on a mask requirement for schools.)" (David Zweig, "The Science of Masking Kids at School Remains Uncertain," *New York Magazine's Intelligencer*, 8/20/21)

EXPERTS' SUGGESTIONS TO POLICYMAKERS: CONSULT PARENTS, CONSIDER IMPACT OF MASKS ON KIDS, MAKE INFORMED DECISIONS BASED ON RELIABLE DATA AND RESEARCH

The World Health Organization And UNICEF Encourage Policymakers To Consider The "Potential Impact Of Wearing A Mask On Learning And Psychosocial Development, In Consultation With Teachers, Parents/Caregivers And/Or Medical Providers." "WHO and UNICEF advise that the decision to use masks for children aged 6-11 should be based on the following factors: Whether there is widespread transmission in the area where the child resides[;] The ability of the child to safely and appropriately use a mask[;] Access to masks, as well as laundering and

replacement of masks in certain settings (such as schools and childcare services)[;] Adequate adult supervision and instructions to the child on how to put on, take off and safely wear masks[;] Potential impact of wearing a mask on learning and psychosocial development, in consultation with teachers, parents/caregivers and/or medical providers[;] Specific settings and interactions the child has with other people who are at high risk of developing serious illness, such as the elderly and those with other underlying health conditions." (World Health Organization, "Coronavirus disease (COVID-19): Children and masks," World Health Organization website, 8/21/20)

- **Researchers in Germany Assert Policymakers Should Take Into Account "The Proven Mask-Induced Mild To Moderate Cognitive Impairment With Impaired Thinking, Decreased Attention And Dizziness, As Well As The Psychological And Neurological Effects" When Considering Mandating Masks For Students.** "The proven mask-induced mild to moderate cognitive impairment with impaired thinking, decreased attention and dizziness, as well as the psychological and neurological effects, should be additionally taken into account when masks are compulsory at school and in the vicinity of both public and non-public transport, also regarding the possibility of an increased risk of accidents (see also occupational health side effects and hazards)." (Kai Kisielinski, Paul Giboni, Andreas Prescher, Bernd Klosterhalfen, David Graessel, Stefan Funken, Oliver Kempski, and Oliver Hirsch, "Is a Mask That Covers the Mouth and Nose Free from Undesirable Side Effects in Everyday Use and Free of Potential Hazards?" *International Journal of Environmental Research and Public Health*, 4/21, 18(8): 4344)

Dr. Marty Makary and Dr. H. Cody Meissner: "Let's See Data Showing The Benefits [Of Masking Students] And Weigh Them Against The Long-Term Harm" Before Mandating Students Wear Masks. "Before we order the masking of 56 million Americans who are too young to vote and don't have a lobby, let's see data showing the benefits and weigh them against the long-term harm." (Marty Makary and H. Cody Meissner, "The Case Against Masks for Children," *The Wall Street Journal*, 8/8/21)

Doctor: A Student Wearing A Mask In School "Should Be An Individual, Nuanced Decision"

Dr. Lucy M. McBride, M.D. And Practicing Internist: "I'm Against Mask Mandates For Kids Bc There Is No One-Size-Fits-All Prescription." "To be clear: I'm against mask mandates for kids bc there is no one-size-fits-all prescription. Kids who are high-risk or who live w/ high-risk, non-immune family may decide, for ex, to mask in school when/if COVID prevalence is high. This should be an individual, nuanced decision" (Lucy McBride, MD, Twitter, 7/9/21)

EXPERTS: DELTA VARIANT SHOULDN'T OPEN THE DOOR TO MASK REQUIREMENTS FOR STUDENTS IN SCHOOLS

"A Common Argument Right Now Is That The Emergence Of The Delta Variant Changes Everything." "A common argument right now is that the emergence of the Delta variant changes everything. Currently, some regions of the U.S. are seeing a surge of infections and hospitalizations among young people. But the numbers coming out of Britain continue to suggest that Delta is not more virulent — that is, it does not

cause more severe illness on an individual basis to unvaccinated people — despite being more contagious. A pediatric immunologist at a major university hospital who was not authorized to speak publicly said, 'It is not biologically plausible that the same variant somehow is more dangerous for kids in the U.S. than it is in the U.K.'" (David Zweig, "The Science of Masking Kids at School Remains Uncertain," New York Magazine's Intelligencer, 8/20/21)

But Experts Indicate The Delta Variant, While A "Major And Concerning" Development, "Probably Shouldn't Change Our Thinking On A Mask Requirement For Schools." "These countries, along with the World Health Organization, whose child-masking guidance differs substantially from the CDC's recommendations, have explicitly recognized that the decision to mask students carries with it potential academic and social harms for children and may lack a clear benefit. To date, the highly transmissible Delta variant has not led them to change this calculus. (Many experts I spoke with told me that while the Delta variant represents a major and concerning new development in the Covid pandemic, it probably shouldn't change our thinking on a mask requirement for schools.)" (David Zweig, "The Science of Masking Kids at School Remains Uncertain," New York Magazine's Intelligencer, 8/20/21)

- **Dr. Elissa Schechter-Perkins: "I Don't Think That Delta Changes The Calculus."** "More broadly, Schecter-Perkins said, 'I don't think that Delta changes the calculus because it still seems clear that it doesn't cause more severe disease, so it still doesn't change the fundamental question of 'What are we trying to achieve by masking kids when they are still extremely unlikely to suffer from severe illness or death if infected?''" (David Zweig, "The Science of Masking Kids at School Remains Uncertain," New York Magazine's Intelligencer, 8/20/21)

This research report was prepared by the Office of the Governor of Montana for informational purposes.

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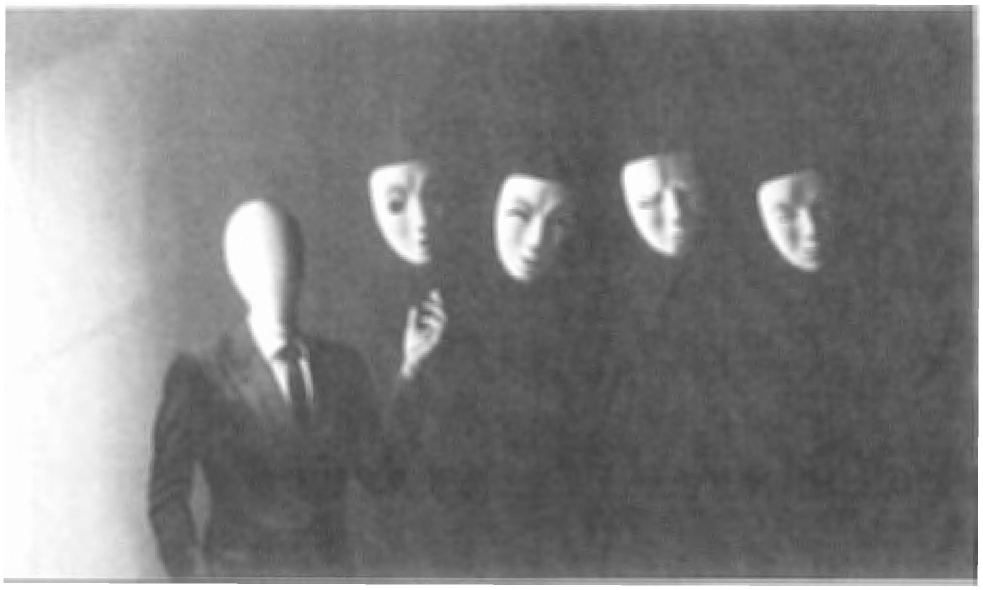
BROWNSTONE » ARTICLES » THE DAMAGE OF MASKING CHILDREN COULD BE IRREPARABLE



The Damage of Masking Children Could be Irreparable

BY ERIC HUSSEY NOVEMBER 3, 2021

PUBLIC HEALTH, SOCIETY 15 MINUTE READ

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Public smiling in photographs probably started in the 1920s. Photography just took too long for people to hold a smile in the

Exhibit AF

early years of photography. So, they sat still instead of sitting happy. Then photos got faster and people started to smile for those photos. But, probably most if not all of us suspect people actually did smile prior to 1920. We just don't have photo-documentation. And way long ago, George Washington probably didn't smile for his portrait because his ivory-tooth dentures hurt.

Dr. David Cook eloquently pondered smiles on Facebook recently saying "The stunning smile lowers perception as it raises pulse; the beautiful smile inspires as it lifts spirits. One smile owns you; one frees you. One you see; one sees you. One absorbs; one reflects. One is of the flesh; one, of the heart. The stunning smile too quickly fades; the beautiful smile shines on and

on."[1]

Ya gotta love a good smile. That assumes you can recognize a smile. Can everyone tell the difference between a wry smile suggesting some deeper internal knowledge and a big grin?

Ayn Rand described faces at length in her writings. In *The Fountainhead*, Rand describes Dominique Francon: "She did not smile, but her face had the lovely serenity that can become a smile without transition." Or, in describing what Dagny Taggart saw upon opening her eyes after crashing at Galt's Gulch in *Atlas Shrugged*: "It was a face that had nothing to hide or to escape, a face with no fear of being seen or of seeing,

so that the first thing she grasped about him was the intense perceptiveness of his eyes—he looked as if his faculty of sight were his best-loved tool and its exercise were a limitless, joyous adventure, as if his eyes imparted a superlative value to himself and to the world—to himself for his ability to see, to the world for being a place so eagerly worth seeing." [2]

What wonderful language to describe smiles, eyes and faces and the significance of faces. Even without the language skills to describe a smile to others with that mastery of imagery, can everyone identify that level of nuance in a smile or other facial expression? What does it suggest if you can't? Are you too shy or not interested

in others? Maybe you share attributes with some syndrome like Aspergers. Maybe you slide a little further up the autism spectrum scale than some of the rest of us.[3,4] Or, maybe, possibly, something interfered with specific visual face-identifying ability development.

The philosopher Emmanuel Levinas thought human relationship and responsibility to the other person both spring from insight occurring primarily in face-to-face encounters. In that face, we find another person's vulnerabilities and receive commands to not harm. It is in the face that class distinctions fade, and from which the Word of God can emanate. It is very difficult to dispose of a person who we

have seen face-to-face. In that face-to-face contact, relationship, and actually humanity, starts and is maintained. [5] The vision science expresses the same thoughts less eloquently when it notes that faces convey fundamental social cues such as social intentions using direction of gaze and emotional states in expressions.[6]

Face-identification ability is specific.[7,8,9,10] Humans have a specific face identification area of the brain, known in research as the FFA: the Fusiform Face Area.[7,8,11] The FFA is in the right hemisphere of the brain. Prior to the age of two, the two hemispheres don't communicate through the corpus callosum as completely as they will later.[7] The left eye early on, then,

provides the vast majority of the visual input to the right hemisphere. Later on communication between the hemispheres increases.

Visual neurology – all neurology – requires the correct or appropriate input to develop. Block the proper stimulus that would drive neural development of specific areas at a time of rapid neural growth, and development of the neural network involved is impaired. The FFA is no different. If the input from the left eye very early in development is impaired, as in congenital cataract, development of the FFA can be impaired.[7,8,9,10,12] Even though the cataract is removed as early as medically feasible or recommended (not the case in some third-world situations), since infant

brains are actively wiring, input to the FFA can be impaired, and therefore its functions impaired.

Recognizing faces develops over time in normal humans.[9] The basics are wired in early: Newborns detect and respond to eyes-nose-mouth. That limited face schematic of the newborn develops into fairly adult face processing, if we view faces as a whole – a Gestalt – by six years of age.[13,14] That Gestalt – the gluing of individual features together into a solid whole – is different from recognizing nuance. Nuance is recognizing subtle changes in position and spacing of the disparate parts of the whole.[8,9,13,14,15,16,17,18,19]

Nuance takes time. Adult face

recognition is completed sometime after 14 years of age. When are the really active periods of neural development? We don't know, other than very general statements like the changes are probably rapid early and slow down maybe in the teens.[7]

The vision science analogizes how we detect faces by describing the human face as a horizontal bar code.[20,21] So, just for the moment, imagine checking out at the grocery store with half of each bar code covered. Before losing that visual, let's look at the neurological development of the ability to detect and discriminate faces and the nuance of the wry smile.

The face discrimination timeline

Eyes, nose, mouth, maybe eyebrows and chin are wired in at birth and infants respond to that combination. At 5 months, infants can detect exaggerations in changes in face detail spacing.[22] Maybe that's why we all think we need to exaggerate our expressions in "talking" to an infant. Blocking input to the FFA with a congenital cataract up to 2 to 6 months of age range interferes with recognizing changes in spacing of facial features – so maybe the change in the corner of the mouth in smiling, but not in recognizing external facial contours. Delaying visual input by as little as 2 months results in permanent deficits.[22]

The classic way in which we describe how we see – visual acuity; 20/20, etc

– is unrelated to that loss of detecting nuance, and 9 more years of development after cataract surgery doesn't fix it.[7] Being able to detect differences between pairs of faces (shown experimentally to early cataract sufferers) will continue to improve to adult levels, but maybe not the detail spacing in a single face. Differentiating face versus non-face is not affected by several years of early cataract blindness, taking just a few weeks of visual experience to develop after the cataracts are removed.[7]

Again, the very basics are wired in. Maybe not so much the nuance shown on a single face and maybe not the emotions represented by facial expression. For example, infant-

cataract sufferers, having had cataracts removed appropriately, are worse at lip reading than age-matched people who did not have early cataracts, but not worse at other visual tasks tested. Higher order face processing, probably carrying nuance, only develops if right hemisphere development is initiated in early infancy.[23]

Around 6 years of age, that gluing together of parts of faces into a whole – the Gestalt – is coming to adult levels, and that is important in distinguishing individual faces. Detecting external contours and sets of features is almost at adult levels, paralleling the maturation of visual sensitivities such as contrast sensitivity and peripheral vision. But, those extra

sets of features also suffer distraction from paraphernalia such as glasses and hats.[22] Different points of view, clothing and lighting influence recognition, and 6-year-olds rely on external features such as hair for recognizing faces as familiar faces. However, face perception is driven by inner facial features, especially the eyes and mouth.[13]

Rapid changes in development occur between 7 and 11 years of age; that is, the elementary school years.[14] The brain regions involved in face detection are actually smaller than in adults but are developing. General perception of spacing of details in objects is developing and at 8 years old, with unlimited time to observe, accuracy of

detecting nuance is pretty good. Between 9 and 11 years old, the switch from relying on external features (face contour, hair, head shape) to relying on recognizing internal features occurs. And, recognizing spacing nuance of features is becoming more adult-like. That recognition of nuance is still not at adult levels at 14 years old, though.[22]

Fear expressed in an observed face seems to be an exception to some of this. Fearful facial expressions are thought to project more directly to the amygdala, the area of the brain at least in part responsible for detecting fearful stimuli or perhaps separating fearful from non-fearful stimuli. Historically the amygdala has been associated with the "fight or flight" reflex. The

amygdala employs more coarse visual data (lower spatial frequencies than the FFA) and emotion-attached memories in determining appropriate response.[21] This perhaps suggests this fearful-expression pathway is a sort-of early warning pathway passing on perception of a fearful situation from a parent to a child; maybe, "We're in trouble, pay attention!"

Adult expectations and injury

As an adult, the expectation is that nuance in the spacing of face features in addition to relying on processing of contours and features will provide reliable recognition of faces, including from different angles, with different lighting, and changes in some of the paraphernalia (new hair style). And

recognizing the wry smile, of course.

Damage to the occipitotemporal region (the FFA) of the right hemisphere of the brain can selectively remove the ability to recognize faces. The inability to recognize faces is termed prosopagnosia. In a 20+ year-old patient, known as LG, who suffers from developmental prosopagnosia, laboratory perceptual learning therapies could not improve face detection, and only slightly improved object recognition.[24] Taken as a whole, if something interferes with development of the FFA, or if injury happens, full function in its role as the face recognition center may not be developable or may not be recoverable at our current understanding of

neurological therapies.

Special cases – Autism

Autism provides a special case in looking at face recognition.[3,4] As tested at around 8 to 9 years of age, autism biases the process of recognizing faces away from holistic – whole face Gestalt – processing. Debate continues as to whether that problem with holistic face processing represents a shift in processing, or perhaps reflects less motivation to develop expertise in face detection. That reduced motivation would be from a lack of reward from social interaction.

So, which comes first? Is it a neurological bias away from normal FFA processing, or does altered ability

to achieve meaningful reward in social interaction change how faces are perceived? If it is the latter, does that suggest risk in altering social interaction in children? In high-functioning autistic adults, the research is unsettled as to whether holistic face processing is slowed, or whether reaction times in a laboratory test situation are just slower.

Implications for life with public health mandates affecting children

In June, 1964, the Declaration of Helsinki was put together to address principles to be used in human experimentation. The Helsinki Declaration declared the individual right to self-determination and to make informed decisions regarding

participation in research. With children, the parents are first in line for informed consent, and then children must also express assent to any research. Individual welfare must always take precedence over the interests of society (and science). [25]

In research language, the face has been described as a horizontal bar code. As with scanning at the grocery store, if that bar code is crushed together or otherwise distorted perpendicular to the bars, the poor checker will have to manually enter the numbers corresponding to the item with the bar code. What happens if half the code is missing? What happens if the majority of faces seen by a child are half-faces, faces missing the bottom half of the

facial bar code?

When we surround children with mask-wearers for a year at a time, are we impairing their face barcode recognition during a period of hot neural development, thus putting full development of the FFA at risk? Does the demand for separation from others, reducing social interaction, add to the potential consequences as it might in autism? When can we be sure that we won't interfere with visual input to the face recognition visual neurology so we don't interfere with brain development? How much time with stimulus interference can we allow without consequences? Those are all questions currently without answers; we don't know. Unfortunately, the

science implies that if we mess up brain development for faces, we may not currently have therapies to undo everything we've done.

The question in the development of face recognition is: What could long-term mask mandates on children do? Another way to phrase the question is, given the development of abilities to discriminate faces and nuances in faces and emotions that show in faces, based on specific face-discrimination neurology in a specific area of the brain, what year-long (and growing) period of time do you want to take the risk of impairing by surrounding children with masked faces while limiting social interaction?

Further, are mask mandates human

experimentation without opportunity for informed consent by the adults and assent by the children?

When will we know? It could be years. Should we anticipate a generation of children who display some sort of impaired face-detection ability suggestive of autism, maybe without actual autism? Perhaps. And what if the one facial detection ability that seems to survive unimpaired is the detection of fear, directly projecting to the amygdala? Do we breed a generation of children who first and foremost see fear in faces, perhaps inappropriately? We hope not.

The wry smile. That subtle twist of the corner of the mouth, perhaps with

some change in the distance between eyes and brows suggesting "I get it. I know you. I understand the situation. It's OK with me," and maybe there's an edge of humor. Not the belly laugh. The dry humor. The "Let me wait a moment until you get the joke" look. That look that says we're comfortable together and enjoying each other.

Were we knowledgeable in putting neural development at risk? Much of that is unknowable since we can only speculate on what might have been. How sad it would be if even a part of a generation saw faces as Ayn Rand described hopeless people at the end of *Atlas Shrugged*: "Empty, hopeless, unfocused faces...but no one could read their meaning."

References

1. Cook D. accessed 1/7/2021 www.facebook.com/photo.php?fbid=527383126264214O&set=a.2073018439390121&type=3
2. Excerpt From: Ayn Rand. "Ayn Rand Novel Collection." Apple Books. https://books.apple.com/us/book/ayn-rand-novel-collection/id453567861
3. Watson TL. *Implications of holistic face processing in autism and schizophrenia *Frontiers in Psychology* | Perception Science July 2013 | Volume 4 | Article 414 | 10 doi: 10.3389/fpsyg.2013.00414 www.frontiersin.org

4. Nishimura M, Rutherford MD, Daphne Maurer D. Converging evidence of configural processing of faces in high-functioning adults with autism spectrum disorders *VISUAL COGNITION*, 2008, 16 (7), 859-891

5. Gunderman R, Masking Humanity: Emmanuel Levinas and the Pandemic, https://lawliberty.org/masking-humanity-emmanuel-levinas-and-the-pandemic/ last accessed 3/18/2021

6. Goffaux, V., van Zon, J., & Schiltz, C. (2011). The horizontal tuning of face perception relies on the processing of intermediate and high spatial

frequencies. *Journal of Vision*, 11(10):1, 1–9, http://www.journalofvision.org/content/11/10/1, doi:10.1167/11.10.1.

7. LeGrande R, Mondlach CJ, Maurer D, Brent HP Expert face processing requires visual input to the right hemisphere during infancy
8. Cheryl L. Grady, Catherine J. Mondloch, Terri L. Lewis, Daphne Maurer Early visual deprivation from congenital cataracts disrupts activity and functional connectivity in the face network *Neuropsychologia* 57 (2014) 122–139
9. Catherine J. Mondloch, Richard Le Grand and Daphne Maurer

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10. Brigitte Röder, Pia Ley, Bhamy H. Shenoy, Ramesh Kekunnaya, and Davide Bottari Sensitive periods for the functional specialization of the neural system for human face processing *PNAS* | October 15, 2013 | vol. 110 | no. 42 16760–16765

www.pnas.org/cgi/doi/10.1073/pnas.1309963110

11. Nancy Kanwisher, Josh McDermott, and Marvin M. Chun The Fusiform Face Area: A Module in Human Extrastriate Cortex Specialized for Face Perception *The Journal of Neuroscience*, June 1, 1997, 17(11):4302–4311.

12. Tapan K. Gandhi, Amy Kalia Singh, Piyush Swami, Suma Ganesh, and Pawan Sinha Emergence of categorical face perception after extended early-onset blindness *PNAS* | June 6, 2017 | vol. 114 | no. 23 | 6139–6143 www.pnas.org/cgi/doi/10.1073/pnas.1616050114

13. Catherine J Mondloch, Richard Le Grand, Daphne Maure Configural face processing develops more slowly than featural face processing *Perception*, 2002, volume 31, pages 553 – 566 DOI:10.1068/p3339
14. Catherine J. Mondloch Anishka Leis and Daphne Maurer Recognizing the Face of Johnny, Suzy, and Me: Insensitivity to the Spacing Among Features at 4 Years of Age *Child Development*, January/February 2006, Volume 77, Number 1, Pages 234 – 243
15. Catherine J Mondloch Rachel Robbins1/2, Daphne Maurer Discrimination of facial features by adults, 10-year-olds, and

cataract-reversal patients *Perception*, 2010, volume 39, pages 184 -194 doi:10.1068/p6153

16. Daniel W. Piepers, Rachel A. Robbins A review and clarification of the terms "holistic," "configural," and "relational" in the face perception literature *Frontiers in Psychology* | Perception Science December 2012 | Volume 3 | Article 559 | 2 published: 17 December 2012 doi: 10.3389/fpsyg.2012.00559

17. Rachel A. Robbins, Yaadwinder Shergill, Daphne Maurer, Terri L. Lewis Development of sensitivity to spacing versus feature changes in pictures of houses: Evidence

for slow development of a general spacing detection mechanism? *Journal of Experimental Child Psychology* 109 (2011) 371–382

18. Richard Le Grand*, Catherine J. Mondloch*, Daphne Maurer*†, Henry P. Brent† Early visual experience and face processing *NATURE* | VOL 410 | 19 APRIL 2001 | www.nature.com p890

19. Catherine J Mondloch Rachel Robbins1⁄2, Daphne Maurer Discrimination of facial features by adults, 10-year-olds, and cataract-reversal patients *Perception*, 2010, volume 39, pages 184 -194 doi:10.1068/p6153

20. Spence, M. L., Storrs, K. R., &

Arnold, D. H. (2014). Why the long face? The importance of vertical image structure for biological "barcodes" underlying face recognition. *Journal of Vision*, 14(8):25, 1–12. http://www.journalofvision.org/content/14/8/25, doi: 10.1167/14.8.25

21. Dakin, S. C., & Watt, R. J. (2009). Biological "bar codes" in human faces. *Journal of Vision*, 9(4):2, 1–10, http://journalofvision.org/9/4/2/, doi:10.1167/9.4.2.

22. Catherine J. Mondloch, Kate S. Dobson, Julie Parsons, Daphne Maurer Why 8-year-olds cannot tell the difference between Steve Martin and Paul Newman:

Factors contributing to the slow development of sensitivity to the spacing of facial features *Experimental Child Psychology* 89 (2004) 159–181

23. Lisa Putzar, Ines Goerendt, Tobias Heed, Gisbert Richard, Christian Büchel, Brigitte Rödera. The neural basis of lip-reading capabilities is altered by early visual deprivation – abstract – *Neuropsychologia* Volume 48, Issue 7, June 2010, Pages 2158-2166 https://doi.org/10.1016/j.neuropsychologia.2010.04.007

24. Lev M, Gilaie-Dotan S, Gotthilf-Nezri D, Yehezkel O, Brooks JL, Perry A, Bentin S, Bonneh Y, Polat U. Training-induced

recovery of low-level vision followed by mid-level perceptual improvements in developmental object and face agnosia. *Developmental Science* (2014), 1-15. DOI: 10.1111/desc.12178

25. Declaration of Helsinki, June 1964 https://en.wikipedia.org/wiki/Declaration_of_Helsinki last accessed 4/5/2021

Author

Eric Hussey

President of the Optometric Extension Program Foundation

(an educational foundation), Chair of the organizing committee for the International Congress of Behavioral Optometry 2024, Chair of the Northwest Congress of Optometry, all under the umbrella of the Optometric Extension Program Foundation. Member of the American Optometric Association and Optometric Physicians of Washington.

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Exhibit AG

A Digest of the Data and Scientific Evidence of Masks, Mask Mandates, and Mask Recommendations

MaskScience.org links to 41 high-impact, peer-reviewed studies illustrating why masks fail to curb or reduce the spread of Covid-19, the negative effects of masking, and the adverse effects on children. This site includes links to numerous randomized clinical trials (RCTs) that evaluated the effects of masking on the airborne transmission of pathogens, including SARS-Cov-2. RCTs are the "gold standard" for measuring the effectiveness of an intervention. Several observational studies are not included on this site for the reasons well articulated in the August 2021 meta-analysis, Do Masks Work? This site is an actively maintained project. New studies are added as they become available. Suggestions are welcome by email.

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Studies on Masks

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PEER REVIEWED Nonpharmaceutical Measures for Pandemic Influenza in Nonhealthcare Settings—Personal Protective and Environmental Measures

PEER REVIEWED Non-pharmaceutical public health measures for mitigating the risk and impact of epidemic and pandemic influenza

PEER REVIEWED The use of masks and respirators to prevent transmission of influenza: a systematic review of the scientific evidence

PEER REVIEWED Surgical Mask to Prevent Influenza Transmission in Households: A Cluster Randomized Trial

PEER REVIEWED Is a Mask Necessary in the Operating

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PEER REVIEWED Postoperative wound infections and surgical face masks: a controlled study

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PEER REVIEWED Contamination by respiratory viruses on outer surface of medical masks used by hospital healthcare workers

Low-cost measurement of face mask efficacy for filtering expelled droplets during speech

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Standard Surgical Masks Do Not Protect Wearer From Getting Swine Flu

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Mask Charts

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PEER REVIEWED Use of face mask by blood donors during the COVID-19 pandemic: Impact on donor hemoglobin concentration: A bane or a boon

PEER REVIEWED A Study on the Effect of Wearing Masks on Stress Response

Chemical cocktail found in face masks

Children and Masks

PEER REVIEWED Is a Mask That Covers the Mouth and Nose Free from Undesirable Side Effects in Everyday Use and Free of Potential Hazards?

PEER REVIEWED Masking Emotions: Face Masks Impair How We Read Emotions

Corona children studies "Co-Ki": First results of a Germany-wide registry on mouth and nose covering (mask) in children

Dangerous pathogens found on children's face masks

Mandatory masks in school are a 'major threat' to children's development, doctors warn

Doctors want coronavirus measures for under-12s in schools to be dropped

The Londoner: Let children be exposed to viruses, says Professor Gupta

The Science of Masking Kids at School Remains Uncertain

COVID-19 School Response Dashboard

School masks: face coverings could damage children's speech development, warn scientists

Making pre-school children wear masks is bad public health

The Case Against Masks for Children

Studies on Masks

PEER REVIEWED Effectiveness of Adding a Mask Recommendation to Other Public Health Measures to Prevent SARS-CoV-2 Infection in Danish Mask Wearers

www.acpjournals.org/doi/10.7326/M20-6817

This is the only peer-reviewed, controlled study completed on COVID-19 and masks worn in the community. It was published in November 2020, and it shows that masks are not effective at protecting the wearer.

"[A] recommendation to wear a surgical mask when outside the home among others did not reduce, at conventional levels of statistical

significance, incident SARS-CoV-2 infection compared with no mask recommendation."

PEER REVIEWED A cluster randomised trial of cloth masks compared with medical masks in healthcare workers

www.ncbi.nlm.nih.gov/pmc/articles/PMC4420971/

"This study is the first RCT of cloth masks, and the results caution against the use of cloth masks.... Moisture retention, reuse of cloth masks and poor filtration may result in increased risk of infection."

PEER REVIEWED Physical interventions to interrupt or reduce the spread of respiratory viruses

www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD006207.pub5/full

"We included 44 new RCTs and cluster-RCTs in this

update, bringing the total number of randomised trials to 67.... There is uncertainty about the effects of face masks.... The pooled results of randomised trials did not show a clear reduction in respiratory viral infection with the use of medical/surgical masks during seasonal influenza. There were no clear differences between the use of medical/surgical masks compared with N95/P2 respirators in healthcare workers when used in routine care to reduce respiratory viral infection.... Harms associated with physical interventions were under-investigated."

"There is moderate certainty evidence that wearing a mask probably makes little or no difference to the outcome of laboratory-confirmed influenza compared to not wearing a mask...."

PEER REVIEWED

Do facemasks protect against COVID-19?

www.ncbi.nlm.nih.gov/pmc/articles/PMC7323223/

"Thus, a pre-symptomatic or mildly infected person wearing a facemask for hours without changing it and without washing hands every time they touched the mask could paradoxically increase the risk of infecting others."

PEER REVIEWED

Optical microscopic study of surface

morphology and filtering efficiency of face masks

www.ncbi.nlm.nih.gov/pmc/articles/PMC6599448/
and
peerj.com/articles/7142/

This was a study of the efficiency of cloth masks over time. Cloth masks are the kind the government says we must wear. Medical masks should be saved for first responders.

"The poor filtering efficiency may have arisen from larger and open pores present in the masks. Interestingly, we found that efficiency dropped by 20% after the 4th washing and drying cycle. We observed a change in pore size and shape and a decrease in microfibers within the pores after washing. Stretching of [cloth mask] surface also altered the pore size and potentially decreased the filtering efficiency."

"The findings of this study suggest that [cloth masks] are not effective, and that effectiveness deteriorates if used after washing and drying cycles and if used under stretched condition."

PEER REVIEWED Face Coverings, Aerosol Dispersion and

Mitigation of Virus Transmission Risk

ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9329130

This study notes what happens to the leakage that comes out the sides of masks, especially when those masks aren't fitted properly. Instead of lighter, dispersed airflow in front of your face, strong jet streams go out the side and over the top of your mask, creating a risk for people around you.

From the Overview: "Surgical and hand-made masks, and face shields, generate several leakage jets, including intense backward and downwards jets that may present major hazards."

"Surgical and handmade masks, and face shields, generate significant leakage jets that have the potential to disperse virus-laden fluid particles by several metres. The different nature of the masks and shields makes the direction of these jets difficult to predict, but the directionality of these jets should be a main design consideration for these covers. They all showed an intense backward airflow for heavy breathing and coughing conditions. It is important to be aware of this flow, to avoid a false sense of security that

may arise when standing to the side of, or behind, a person wearing a surgical, or handmade mask, or shield. This is of relevance given the potential for some wearers of surgical masks to turn their face to the side when they cough, during face-to-face interactions with a colleague. In doing so, our data show that there is a risk that this backward jet is directed closer to a person standing in front of the wearer. Additionally, clinicians working around a patient, in the confined space around an intensive care bed or an operating table, are likely to be exposed to these side and backward leakage jets from surgical masks worn by colleagues."

PEER REVIEWED Simple Respiratory Protection—Evaluation of the Filtration Performance of Cloth Masks and Common Fabric Materials Against 20–1000 nm Size Particles

academic.oup.com/annweh/article/54/7/789/202744

"The results obtained in the study showed that cloth masks and other fabric materials tested in

the study had 40–90% instantaneous penetration levels when challenged with polydisperse NaCl aerosols . . . . A poor filtration performance is expected for improvised fabric materials because these materials are not designed for respiratory protection."

Comparison of Filtration Efficiency and Pressure Drop in Anti-Yellow Sand Masks, Quarantine Masks, Medical Masks, General Masks, and Handkerchiefs

aaqr.org/articles/aaqr-13-06-oa-0201

"General masks and handkerchiefs have no protection function in terms of the aerosol filtration efficiency."

"Medical masks, general masks, and handkerchiefs were found to provide little protection against respiratory aerosols."

Experimental investigation of indoor

aerosol dispersion and accumulation in the context of COVID-19: Effects of masks and ventilation

aip.scitation.org/doi/10.1063/5.0057100

"The results show that a standard surgical and three-ply cloth masks, which see current widespread use, filter at apparent efficiencies of only 12.4% and 9.8%, respectively. Apparent efficiencies of 46.3% and 60.2% are found for KN95 and R95 masks, respectively, which are still notably lower than the verified 95% rated ideal efficiencies. Furthermore, the efficiencies of a loose-fitting KN95 and a KN95 mask equipped with a one-way valve were evaluated, showing that a one-way valve reduces the mask's apparent efficiency by more than half (down to 20.3%), while a loose-fitting KN95 provides a negligible apparent filtration efficiency (3.4%)."

PEER REVIEWED Universal Masking in Hospitals in the Covid-19 Era

www.nejm.org/doi/full/10.1056/NEJMp2006372

"We know that wearing a mask outside health care facilities offers little, if any, protection from infection. . . . the desire for widespread masking is a reflexive reaction to anxiety over the pandemic."

*But then, in an interesting twist, the study concludes that the usefulness of universal masking **even in a hospital** is limited and that the biggest benefit is psychological. (Note: They are addressing the staff that isn't directly responsible for COVID patients.)*

"A mask alone will not prevent health care workers with early Covid-19 from contaminating their hands and spreading the virus to patients and colleagues. Focusing on universal masking alone may, paradoxically, lead to more transmission of Covid-19 if it diverts attention from implementing more fundamental infection-control measures. . . . [Masks are] talismans that may help increase health care workers' perceived sense of safety, well-being, and trust in their hospitals."

PEER REVIEWED Disposable surgical face masks for preventing surgical wound infection in clean surgery

pubmed.ncbi.nlm.nih.gov/27115326/

"There was no statistically significant difference in infection rates between the masked and unmasked group in any of the trials."

"From the limited results it is unclear whether the wearing of surgical face masks by members of the surgical team has any impact on surgical wound infection rates for patients undergoing clean surgery."

PEER REVIEWED Face seal leakage of half masks and surgical masks

pubmed.ncbi.nlm.nih.gov/4014006/

"Filtration and leakage were studied as a function of particle size over a diameter range of 0.3-10 micron.... The filtration efficiency of the filter materials was good, over 95%, for particles above 5 micron in diameter but great variation existed for smaller particles."

PEER REVIEWED Aerosol and Surface Stability of SARS-CoV-2 as

Compared with SARS-CoV-1

www.nejm.org/doi/full/10.1056/nejmc2004973

"Our results indicate that aerosol and fomite transmission of SARS-CoV-2 is plausible, since **the virus can remain viable and infectious in aerosols for hours** and on surfaces up to days (depending on the inoculum shed)." *(Emphasis added.)*

PEER REVIEWED Aerosol penetration through surgical masks

pubmed.ncbi.nlm.nih.gov/1524265/

"Although surgical mask media may be adequate to remove bacteria exhaled or expelled by health care workers, they may not be sufficient to remove the submicrometer-size aerosols containing pathogens to which these health care workers are potentially exposed."

PEER REVIEWED Use of surgical face masks to reduce the incidence of the common

cold among health care workers in Japan: a randomized controlled trial

pubmed.ncbi.nlm.nih.gov/19216002/

"Face mask use in health care workers has not been demonstrated to provide benefit in terms of cold symptoms or getting colds."

PEER REVIEWED Face masks to prevent transmission of influenza virus: a systematic review

doi.org/10.1017/S0950268809991658

"While there is some experimental evidence that masks should be able to reduce infectiousness under controlled conditions, there is less evidence on whether this translates to effectiveness in natural settings. There is little evidence to support the effectiveness of face masks to reduce the risk of infection."

PEER REVIEWED The use of masks and respirators to prevent transmission of influenza: a systematic review of the scientific evidence

onlinelibrary.wiley.com/doi/epdf/10.1111/j.1750-2659.2011.00307.x

"None of the studies we reviewed established a conclusive relationship between mask/respirator use and protection against influenza infection."

"In conclusion, there is a limited evidence base to support the use of masks and/or respirators in healthcare or community settings."

PEER REVIEWED Aerosol penetration and leakage characteristics of masks used in the health care industry

pubmed.ncbi.nlm.nih.gov/8239046/

"We conclude that the protection provided by surgical masks may be insufficient in environments containing potentially hazardous submicrometer-sized aerosols."

PEER REVIEWED Nonpharmaceutical Measures for Pandemic Influenza in Nonhealthcare Settings—Personal Protective and Environmental Measures

wwwnc.cdc.gov/eid/article/26/5/19-0994_article

"We found no significant reduction in influenza transmission with the use of face masks."

PEER REVIEWED Non-pharmaceutical public health measures for mitigating the risk and impact of epidemic and pandemic influenza

apps.who.int/iris/bitstream/handle/10665/329439/WHO-WHE-IHM-GIP-2019.1-eng.pdf?ua=1

"Ten RCTs were included in meta-analysis, and there was no evidence that face masks are effective in reducing transmission of laboratory-confirmed influenza."

PEER REVIEWED The use of masks and respirators to prevent transmission of influenza: a systematic review of the scientific evidence

www.ncbi.nlm.nih.gov/pmc/articles/PMC5779801

"None of the studies we reviewed established a conclusive relationship between mask/respirator use and protection against influenza infection.

"In conclusion, there is a limited evidence base to support the use of masks and/or respirators in healthcare or community settings."

PEER REVIEWED Surgical Mask to Prevent Influenza Transmission in

Households: A Cluster Randomized Trial

journals.plos.org/plosone/article?id=10.1371/journal.pone.0013998

"We evaluated the effectiveness of facemask use by index cases for limiting influenza transmission by large droplets produced during coughing in households. . . . In various sensitivity analyses, we did not identify any trend in the results suggesting effectiveness of facemasks."

PEER REVIEWED Is a Mask Necessary in the Operating Theatre?

www.ncbi.nlm.nih.gov/pmc/articles/PMC2493952/pdf/annrcse01509-0009.pdf

"No masks were worn in one operating theatre for 6 months. There was no increase in the incidence of wound infection."

"The finding that there was an appreciable fall in the wound infection rate when masks were not worn certainly warrants further investigation. This trial was designed only to see whether wound infection increased, as had been predicted, when

masks were not worn. It did not. The conclusion is that the wearing of a mask has very little relevance to the wellbeing of patients undergoing routine general surgery and it is a standard practice that could be abandoned."

PEER REVIEWED Postoperative wound infections and surgical face masks: a controlled study

pubmed.ncbi.nlm.nih.gov/1853618/

"It has never been shown that wearing surgical face masks decreases postoperative wound infections. On the contrary, a 50% decrease has been reported after omitting face masks. The present study was designed to reveal any 30% or greater difference in general surgery wound infection rates by using face masks or not. . . . [The results] indicated that the use of face masks might be reconsidered."

PEER REVIEWED An Experimental Study of the Efficacy of Gauze Face Masks

ajph.aphapublications.org/doi/pdf/10.2105/AJPH.10.1.34

Completed by a scientist in the wake of the 1918 Spanish flu. He concludes that masks would need to be very thick to be effective and (even then) leakage out the side of the mask would be problematic.

"The reason for this apparent failure of the mask was a subject for speculation among epidemiologists, for it had long been the belief of many of us that droplet borne infections should be easily controlled in this manner. The failure of the mask was a source of disappointment, for the first experiment in San Francisco was watched with interest with the expectation that if it proved feasible to enforce the regulation the desired result would be achieved. The reverse proved true. The masks, contrary to expectation, were worn cheerfully and universally, and also, contrary to expectation of what should follow under such circumstances, no effect on the epidemic curve was to be seen. Something was plainly wrong with our hypotheses."

"Masks have not been demonstrated to have a degree of efficiency that would warrant their compulsory application for the checking of epidemics."

PEER REVIEWED Analysis of the Effects of COVID-19 Mask Mandates on Hospital Resource Consumption and Mortality at the County Level

www.ncbi.nlm.nih.gov/pmc/articles/PMC8395971

Bexar County is the 16th largest county in the United States, with a population of 2,009,324 as of April 1, 2020.

"[F]ew data are available to assess mask effects via executive order on a population basis. We assess the effects of a county-wide mask order... in Bexar County, Texas."

"There was no reduction in per-population daily mortality, hospital bed, ICU bed, or ventilator occupancy of COVID-19-positive patients attributable to the implementation of a mask-wearing mandate."

PEER REVIEWED Contamination by respiratory viruses on

outer surface of medical masks used by hospital healthcare workers

bmcinfectdis.biomedcentral.com/articles/10.1186/s12879-019-4109-x

“Respiratory pathogens on the outer surface of the used medical masks may result in self-contamination. The risk is higher with longer duration of mask use (>6h) and with higher rates of clinical contact.”

Low-cost measurement of face mask efficacy for filtering expelled droplets during speech

www.ncbi.nlm.nih.gov/pmc/articles/PMC7467698

“We noticed that speaking through some masks (particularly the neck gaiter) seemed to disperse the largest droplets into a multitude of smaller droplets, which explains the apparent increase in droplet count relative to no mask in that case. Considering that smaller particles are airborne

longer than large droplets (larger droplets sink faster), the use of such a mask might be counterproductive."

Aerosol filtering efficiency of respiratory face masks used during the COVID-19 pandemic

www.medrxiv.org/content/10.1101/2020.07.16.20155119v1

"Cloth masks were found to be ineffective for the assigned task."

"Market available cloth masks were inefficient at any aerosol size range."

Facemasks and similar barriers to prevent respiratory illness such as COVID-19: A rapid systematic review

www.medrxiv.org/content/10.1101/2020.04.01.20049528v1.full.pdf

"The evidence is not sufficiently strong to support widespread use of facemasks as a protective measure against COVID19. However, there is enough evidence to support the use of facemasks for short periods of time by particularly vulnerable individuals when in transient higher risk situations."

Expert Commentary

A Virologist and WHO to Clarify: The Mouth-Nose Protection can be a breeding ground for many germs

healthnews2me.com/fitness/a-virologist-and-who-to-clarify-the-mouth-nose-protection-can-be-a-breeding-ground-for-many-germs/

Hendrik Streeck, professor for virology and the director of the Institute of virology and HIV Research at the University Bonn

"People crumple the masks in the pocket, touch you constantly, and strap yourself in for two weeks again and again in front of the mouth, probably unwashed."

"This is a wonderful breeding ground for bacteria and fungi."

Why is Sweden not recommending face masks to the public?

www.thelocal.se/20200514/explained-why-is-sweden-not-recommending-face-masks-to-the-public

Johan Carlson, Director General of the Swedish Public Health Agency Folkhälsomyndigheten:

- "Face masks in public spaces do not provide any greater protection to the population."

Swedish state epidemiologist Anders Tegnell:

- "The virus can gather in the mask and when you take it off, the virus can be transferred to your hands and thereby spread further."
- "Face masks can be effective against larger free floating particles, but nothing suggests that they help protect you from air-borne viruses."

Are Face Masks Effective?

The Evidence (Swiss Policy Research)

swprs.org/covid-masks-review/

"So far, most studies found little to no evidence for the effectiveness of cloth face masks in the general population, neither as personal protective equipment nor as a source control."

"In many states, coronavirus infections strongly increased after mask mandates had been introduced. . . . a direct comparison between US states with and without mask mandates indicates that mask mandates have made no difference."

"The WHO admitted to the BBC that its June 2020 mask policy update was due not to new evidence but 'political lobbying.'"

"There is still little to no scientific evidence for the effectiveness of cloth face masks in the general population, and the introduction of mandatory masks couldn't contain or slow the epidemic in most countries. If used improperly, masks may increase the risk of infection." *(From summary of evidence on intro page, here:*

swprs.org/facts-about-covid-19/

Do face masks work? A note on the evidence

web.archive.org/web/20200430074734/https://www.spectator.co.uk/article/face-masks-should-there-be-a-cover-up-

Former professor of pathology and NHS consultant: "These [cloth] masks are doing little."

Is Routine Use of a Face Mask Necessary in the Operating Room?

doi.org/10.1097/ALN.0b013e3181fcf122

"Recognizing the lack of sound scientific evidence, we have changed facemask routines in several units at the Karolinska University Hospital. . . . [T]he evidence to support this practice does not exist, and studies to establish differences in infection rates with or without face masks will likely be difficult to design and implement given the small potential effect."

Standard Surgical Masks

Do Not Protect Wearer From Getting Swine Flu

insidesurgery.com/2009/04/surgical-masks-protect-swine-flu/

"Surgical masks will not block aerosolized particles as small as a droplet containing influenza virions from entering the airway. They essentially stop only spittle from a surgeon's mouth and mucous from a surgeon's nose from inadvertently dropping into a wound. . . . In addition to the too large pore size of a standard surgical mask, they are not form fitting to the face and allow "leakage" of aerosolized droplets around the edges."

European Centre for Disease Prevention and Control. Using Face Masks in the Community: First Update.

www.ecdc.europa.eu/sites/default/files/documents/covid-19-face-masks-community-first-update.pdf

"**Evidence** for the effectiveness of non-medical

face masks, face shields/visors and respirators in the community **is scarce and of very low certainty**. Additional high-quality studies are needed to assess the relevance of the use of medical face masks in the COVID-19 pandemic." *(Emphasis added.)*

"Based on the assessment of the available scientific evidence, no recommendation can be made on the preferred use of medical or non-medical face masks in the community."

"The very limited scientific evidence regarding the use of respirators in the community does not support their mandatory use in place of other types of face masks in the community.... [T]he difficulties to ensure their appropriate fitting and use in community settings as well as potential adverse effects related to lower breathability should be taken into account."

World Health Organization

apps.who.int/iris/rest/bitstreams/1279750/retrieve

The WHO made headlines last summer when it changed its guidance on masks, but if you read the guidance released in June 2020, WHO still seems to have many reservations about the use of masks. And, as noted in the Swiss Policy Research

link, the changed guidance was apparently prompted by political considerations, not scientific ones. Full disclosure: WHO watered down this guidance still more in December 2020, but left most of the list of potential harms.

"At the present time, the widespread use of masks by healthy people in the community setting is not yet supported by high quality or direct scientific evidence and there are potential benefits and harms to consider."

"Potential harms/disadvantages

The likely disadvantages of the use of mask by healthy people in the general public include:

- potential increased risk of self-contamination due to the manipulation of a face mask and subsequently touching eyes with contaminated hands;
- potential self-contamination that can occur if non-medical masks are not changed when wet or soiled. This can create favourable conditions for microorganism to amplify;
- potential headache and/or breathing difficulties, depending on type of mask used;
- potential development of facial skin lesions, irritant dermatitis or worsening acne, when used frequently for long hours;

- difficulty with communicating clearly;
- potential discomfort;
- a false sense of security, leading to potentially lower adherence to other critical preventive measures such as physical distancing and hand hygiene;
- poor compliance with mask wearing, in particular by young children;
- waste management issues; improper mask disposal leading to increased litter in public places, risk of contamination to street cleaners and environment hazard;
- difficulty communicating for deaf persons who rely on lip reading;
- disadvantages for or difficulty wearing them, especially for children, developmentally challenged persons, those with mental illness, elderly persons with cognitive impairment, those with asthma or chronic respiratory or breathing problems, those who have had facial trauma or recent oral maxillofacial surgery, and those living in hot and humid environments.

Mask Charts

These links look to correlation, none are controlled

studies, but mask charts around the globe consistently show COVID cases increasing after mask mandates are implemented. Do masks actively make things worse, as some of the studies above suggest they might?

PEER REVIEWED Mask mandate and use efficacy for COVID-19 containment in US States

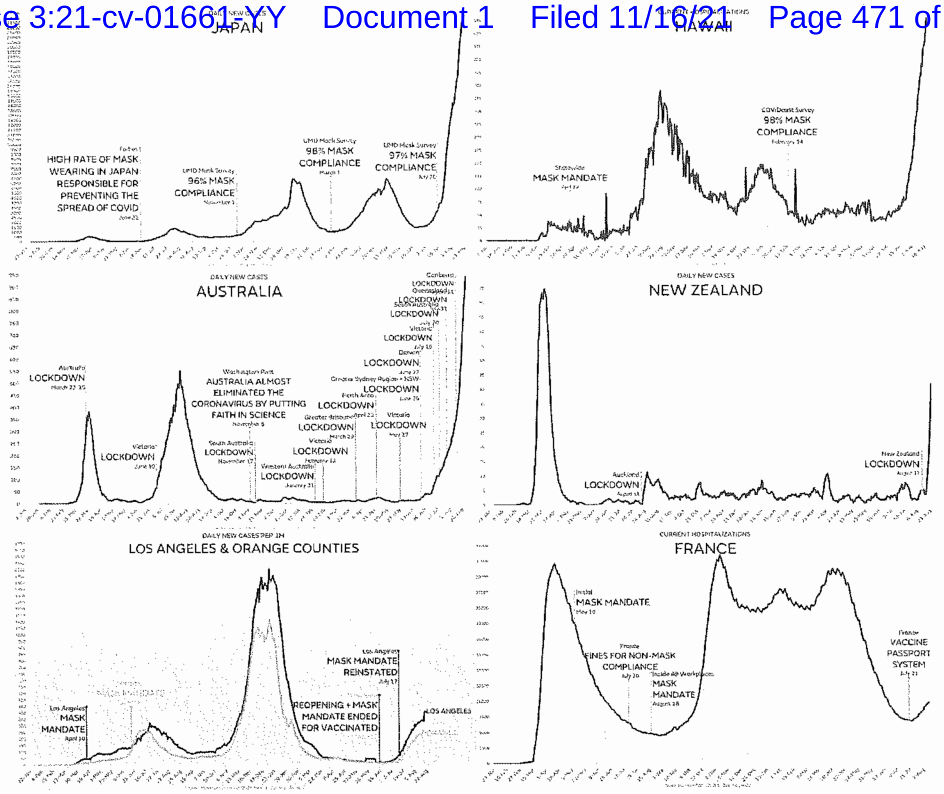
escipub.com/irjph-2021-08-1005

"We did not observe association between mask mandates or use and reduced COVID-19 spread in US states."

Unmasked: Mask Charts from Ian Miller

ianmsc.substack.com/p/the-more-masks-fail-the-more-we-need

"While we have no way to predict how far down the anti-science rabbit hole the CDC will continue to sink, we can look at how their guidance, their recommendation to wear masks is faring in a number of areas in the US and beyond that have followed their evidence-free advice."



For the latest charts illustrating the ineffectiveness of masks and mask mandates, Ian Miller on Twitter is an essential account to follow, and visit his account on Substack.

COVID-19 Mitigation Practices and COVID-19 Rates in Schools: Report on Data from Florida, New York and Massachusetts

www.medrxiv.org/content/10.1101/2021.05.19.21257467v1.full-text

"This paper reports on the correlation of mitigation practices with staff and student COVID-19 case rates in Florida, New York, and Massachusetts

during the 2020-2021 school year. . . We do not find any correlations with mask mandates."

Mask mandate and use efficacy in state-level COVID-19 containment

www.medrxiv.org/content/10.1101/2021.05.18.21257385v1.full.pdf

"Case growth was independent of mandates at low and high rates of community spread, and mask use did not predict case growth during the Summer or Fall-Winter waves."

"Conclusions: Mask mandates and use are not associated with slower state-level COVID-19 spread during COVID 19 growth surges. Containment requires future research and implementation of existing efficacious strategies."

Negative Effects

Is a Mask That Covers the Mouth and Nose Free from Undesirable Side

Effects in Everyday Use and Free of Potential Hazards?

www.mdpi.com/1660-4601/18/8/4344/htm

This study documents negative physical, psychological, and developmental consequences from long-term mask use. There are dozens of effects—too many to summarize here. The study is worth reading in full.

"Extended mask-wearing by the general population could lead to relevant effects and consequences in many medical fields. . . . According to the scientific data, mask wearers as a whole show a striking frequency of typical, measurable, physiological changes associated with masks."

PEER REVIEWED Effect of a surgical mask on six minute walking distance

pubmed.ncbi.nlm.nih.gov/29395560/

"Wearing a surgical mask modifies significantly and clinically dyspnea…."

PEER REVIEWED

Effect of facemasks on empathy and relational continuity: a randomised controlled trial in primary care

www.ncbi.nlm.nih.gov/pmc/articles/PMC3879648/

"In this large randomized controlled trial, we found that the wearing of facemasks by doctors had little effect on patient enablement and satisfaction but had a significant and negative effect on patients' perceptions of the doctors' empathy."

"Facemasks offer limited protection in preventing infection and aerosol transmission through mucous membranes (i.e., conjunctivae). Meanwhile, a negative impact on the patient's perceived empathy and relational continuity can reduce potential therapeutic effects such as decreased depression, improved immune response, improved quality of life and improved health outcomes."

PEER REVIEWED

"Exercise with facemask; Are we handling a devil's sword?"

- A physiological hypothesis

pubmed.ncbi.nlm.nih.gov/32590322

"Exercising with facemasks may reduce available Oxygen and increase air trapping preventing substantial carbon dioxide exchange. The hypercapnic hypoxia may potentially increase acidic environment, cardiac overload, anaerobic metabolism and renal overload, which may substantially aggravate the underlying pathology of established chronic diseases. Further contrary to the earlier thought, no evidence exists to claim the facemasks during exercise offer additional protection from the droplet transfer of the virus. Hence, we recommend social distancing is better than facemasks during exercise and optimal utilization rather than exploitation of facemasks during exercise."

PEER REVIEWED Mask use during high impact exercise in the pandemic

pubmed.ncbi.nlm.nih.gov/32865234

"In case of intense physical exercise, the use of masks is not recommended because of the

enhancing effect on PCO2. It would not allow the complete expulsion of the expired CO2 and would increase its concentration, along with the typical increase of the breathing rate during the exercise."

PEER REVIEWED Respiratory consequences of N95-type Mask usage in pregnant healthcare workers—a controlled clinical study

aricjournal.biomedcentral.com/articles/10.1186/s13756-015-0086-z

"Breathing through N95 mask materials have been shown to impede gaseous exchange and impose an additional workload on the metabolic system of pregnant healthcare workers."

PEER REVIEWED Headaches Associated With Personal Protective Equipment – A Cross-Sectional Study Among Frontline Healthcare Workers

During COVID-19

headachejournal.onlinelibrary.wiley.com/doi/10.1111/head.13811

"Most healthcare workers develop de novo PPE-associated headaches or exacerbation of their pre-existing headache disorders."

"The magnitude of this condition is clinically significant and might worsen if the current outbreak spreads widely and stays for a longer time, affecting the work performance of healthcare workers."

PEER REVIEWED Effects of wearing N95 and surgical facemasks on heart rate, thermal stress and subjective sensations

www.ncbi.nlm.nih.gov/pmc/articles/PMC7087880/

Therefore, it can be concluded that N95 and surgical facemasks can induce significantly different temperatures and humidity in the microclimates of facemasks, which have profound

influences on heart rate and thermal stress and subjective perception of discomfort.

PEER REVIEWED Use of face mask by blood donors during the COVID-19 pandemic: Impact on donor hemoglobin concentration: A bane or a boon

www.trasci.com/article/S1473-0502(21)00126-9/fulltext

"This study including 19504 blood donors spanning over one and a half year shows that prolonged use of face mask by blood donors may lead to intermittent hypoxia and consequent increase in hemoglobin mass."

PEER REVIEWED A Study on the Effect of Wearing Masks on Stress Response

ripublication.com/irph/ijert20/ijertv13n4_28.pdf

“It is well known that wearing a mask may cause breathing problems and hypoxia. And this situation will become more serious with the time of wearing the mask and the degree of protection of the mask. . . . Prolonged wearing may cause permanent damage to the respiratory system. Due to the lack of oxygen in the brain, it also damages our nervous system, causing adverse physiological reactions, such as dizziness, chest tightness, and psychological reactions about anxiety and depression. . . . We believe that as the duration of wearing a mask is longer, the more severe the situation of hypoxia, the more severe the body's response to hypoxia will be. The range of SDNN value decline will be greater. This also means that the people will suffer more stress, which harm people's health. Therefore, people need to know the negative effects of the mask and use the mask appropriately.”

Chemical cocktail found in face masks

www.ecotextile.com/2021040127603/dyes-chemicals-news/exclusive-chemical-cocktail-found-in-face-masks.html

“[M]ask wearers unwittingly run the risk of breathing in carcinogens, allergens and tiny synthetic microfibres by wearing both textile and nonwoven surgical masks for long periods of time.”

"'What we are breathing through our mouth and nose is actually hazardous waste,' said Professor [Michael] Braungart, [director at the Hamburg Environmental Institute,] who ran preliminary tests on used surgical masks that found traces of chemicals such as the known carcinogen aniline as well as formaldehyde and optical brighteners -- both heavily restricted on consumer goods by European and US authorities to minute parts per million concentrations."

"[L]eading scientists are now questioning whether the real risk of exposure to potentially hazardous chemicals from long-term mask wearing is actually higher than the risk of coming into contact with the Sars-CoV-2 virus...."

Children and Masks

PEER REVIEWED Is a Mask That Covers the Mouth and Nose Free from Undesirable Side Effects in Everyday Use and Free of Potential Hazards?

www.mdpi.com/1660-4601/18/8/4344/htm

"Children are particularly vulnerable and may be more likely to receive inappropriate treatment or additional harm. It can be assumed that the potential adverse mask effects described for adults are all the more valid for children..... masks block the foundation of human communication and the exchange of emotions and not only hinder learning but deprive children of the positive effects of smiling, laughing and emotional mimicry. The effectiveness of masks in children as a viral protection is controversial, and there is a lack of evidence for their widespread use in children . . . . "

PEER REVIEWED Masking Emotions: Face Masks Impair How We Read Emotions

www.frontiersin.org/articles/10.3389/fpsyg.2021.669432/full#h1

"a mask obstructing a face limits the ability of people of all ages to infer emotions expressed by facial features, but the difficulties associated with the mask's use are significantly pronounced in children aged between 3 and 5 years old. These findings are of essential importance, as they suggest that we live in a time that may potentially affect the development of social and emotion reasoning . . . ."

Corona children studies "Co-Ki": First results of a Germany-wide registry on mouth and nose covering (mask) in children

www.researchsquare.com/article/rs-124394/v2

"Impairments caused by wearing the mask were reported by 68% of the parents. These included irritability (60%), headache (53%), difficulty concentrating (50%), less happiness (49%), reluctance to go to school/kindergarten (44%), malaise (42%) impaired learning (38%) and drowsiness or fatigue (37%)."

"[A]dults need to collectively reflect the circumstances under which they would be willing to take a residual risk upon themselves in favor of enabling children to have a higher quality of life without having to wear a mask."

Dangerous pathogens found on children's face masks

rationalground.com/dangerous-pathogens-found-on-childrens-face-masks/

Parents in Florida sent their kids' school masks to a lab for analysis. The masks had been worn for only one day.

The analysis detected the following 11 dangerous pathogens on the masks:

- Streptococcus pneumoniae (pneumonia)
- Mycobacterium tuberculosis (tuberculosis)
- Neisseria meningitidis (meningitis, sepsis)
- Acanthamoeba polyphaga (keratitis and granulomatous amebic encephalitis)
- Acinetobacter baumanni (pneumonia, blood stream infections, meningitis, UTIs—resistant to antibiotics)
- Escherichia coli (food poisoning)
- Borrelia burgdorferi (causes Lyme disease)
- Corynebacterium diphtheriae (diphtheria)
- Legionella pneumophila (Legionnaires' disease)
- Staphylococcus pyogenes serotype M3 (severe infections—high morbidity rates)
- Staphylococcus aureus (meningitis, sepsis)

Mandatory masks in school are a 'major threat'

to children's development, doctors warn

www.brusselstimes.com/news/belgium-all-news/health/130480/face-mask-obligation-in-school-major-threat-to-childrens-development-doctors-say/

"Mandatory face masks in schools are a major threat to their development. It ignores the essential needs of the growing child. The well-being of children and young people is highly dependent on emotional attachment to others."

Doctors want coronavirus measures for under-12s in schools to be dropped

www.brusselstimes.com/belgium/185909/doctors-want-coronavirus-measures-for-12s-in-schools-to-be-dropped/

"'Testing children, imposing mouth masks and quarantine go against the principle of "primum non nocere" (first, do no harm) which is included in the Hippocratic Oath that doctors took,' the [Royal Academy of Medicine of Belgium] wrote in the statement. These drastic actions do much more

damage to the children in the short and long term than going through the infection itself."

The Londoner: Let children be exposed to viruses, says Professor Gupta

www.standard.co.uk/news/londoners-diary/the-londoner-let-children-be-exposed-to-viruses-says-professor-gupta-a4538386.html

What if social distancing and over-sanitizing robs our kids of their opportunity to be low risk when it comes to COVID 19?

"[E]vidence is mounting that early exposure to these various coronaviruses is what enables people to survive them."

The Science of Masking Kids at School Remains Uncertain

nymag.com/intelligencer/2021/08/the-science-of-masking-kids-at-school-remains-uncertain.html

"Over and over, studies and reports on children in schools with low transmission rates claim in their summaries that masking students helped keep transmission down. But looking at the underlying data in these studies, masks were always required or widely worn, and implemented in concert with a variety of other interventions, such as increased ventilation. Without a comparison group that didn't require student masking, it's difficult or impossible to isolate the effect of masks. (This is the error made by Duke University researchers who wrote a report about North Carolina schools, later summarized in a New York Times opinion piece.) **I reviewed 17 different studies cited by the CDC in its K-12 guidance as evidence that masks on students are effective, and not one study looked at student mask use in isolation from other mitigation measures, or against a control. Some even demonstrated that no student masking correlated with low transmission.**" *[Emphasis added.]*

COVID-19 School Response Dashboard

statsiq.co1.qualtrics.com/public-dashboard/v0/dashboard/5f78e5d4de521a001036f78e#/dashboard/5f78e5d4de521a001036f78e

This website is worth exploring. It contains charts showing that "mask mandatory" schools did worse than "mask optional" schools last year. It also explores other social distancing measures.

School masks: face coverings could damage children's speech development, warn scientists

www.telegraph.co.uk/news/2020/08/26/school-masks-potential-damage-speech-development-far-greater/

Newspaper reporting on the conclusions of the Children's Task and Finish Group, endorsed by the Scientific Advisory Group of Emergencies (in the U.K.)

"detrimental development impacts [of masks] may be greater than the potential protective benefit"

"The risks of affecting or damaging general speech and language development is far greater than any risks of children transmitting."

"Viewing of faces is essential for brain development in both younger and older children, and in learning to speak/phonics, much of which is based on phonemic awareness."

Making pre-school children wear masks is bad public health

osf.io/65tdh/

Dr. Robert Hughes, who earned a Master in Public Health at the Harvard School of Public Health, is the lead author of this commentary.

"Children are not small adults. This is a critical point that many pediatricians and other child health professionals get bored of saying, yet it does seem to need repeating. While children have the lowest risk from COVID-19 directly, they risk suffering the indirect impacts of policy decisions, many of which appear to have been made with next to no explicit consideration of their interests. Public health interventions should not only be about infectious disease control, they should consider a broad set of outcomes. In addition, they ought to consider vulnerability, including that in early childhood -- a time when young children's brains are developing rapidly and are most susceptible to adversity. We believe that

mandating masking of pre-school children is not in line with public health principles, and needs to be urgently re-considered."

"the harms of this policy are likely to be damaging, potentially considerably so. Given this, and the influence that the CDC and Dr Fauci have both in the US and globally, we believe an urgent re-consideration of this policy is needed."

The Case Against Masks for Children

cryptpad.fr/pad/#/2/pad/view/wiXVwkUdAgkQxpDbPxbfiNQMC8omb VXhiD65AfkDZpM/embed/

Dr. Marty Makary, professor at Johns Hopkins School of Medicine, and Dr. H. Cody Meissner, chief of pediatric infectious diseases at Tufts Children's Hospital, make their case against masks for children.

"Those who have myopia can have difficulty seeing because the mask fogs their glasses.... Masks can cause severe acne and other skin problems. The discomfort of a mask distracts some children from learning. By increasing airway resistance during exhalation, masks can lead to increased levels of carbon dioxide in the blood. And masks can be vectors for pathogens.... Chronic and prolonged

mouth breathing can alter facial development....”

“The possible psychological harm of widespread masking is an even greater worry.... Covering a child's face mutes these nonverbal forms of communication and can result in robotic and emotionless interactions, anxiety and depression.... The adverse developmental effects of requiring masks for a few weeks are probably minor. We can't say that with any confidence when the practice stretches on for months or years.”

The Science of Masking Kids at School Remains Uncertain

nymag.com/intelligencer/2021/08/the-science-of-masking-kids-at-school-remains-uncertain.html

“Those who have myopia can have difficulty seeing because the mask fogs their glasses.... Masks can cause severe acne and other skin problems. The discomfort of a mask distracts some children from learning. By increasing airway resistance during exhalation, masks can lead to increased levels of carbon dioxide in the blood. And masks can be vectors for pathogens.... Chronic and prolonged mouth breathing can alter facial development....”

Suggest a Mask Study

Disclosures and Acknowledgments

MaskScience.org was created and is maintained by concerned volunteer citizens. We have no connection with and have received no funding or compensation from any third parties. We have no affiliation with any political or activist organizations, individuals, intermediaries, or proxies. We have no motive, ulterior or otherwise, other than aggregating and presenting authoritative, peer-reviewed information to help public and private sector decision-makers make evidence-based, data-driven choices.

Read why peer-review and randomized clinical trials (RCTs) are important tools to reduce bias, and understand why low quality observational studies are excluded from this site.

To help enhance and expand its accessibility, a substantial amount of content on this site has been duplicated from Mask Science with permission from its author. It has been supplemented with additional content. Where

appropriate, the content has been updated to point to the latest revision of the study as it has worked its way through the peer-review process. The publishers of MaskScience.org thank all those who have contributed to this website for their hard work and effort.

But What About the Pro-Mask Studies?

Many pro-mask studies have emerged since April 2020. They are not included here for a few reasons:

(1) Why were these studies completed after the mask recommendation changed? Shouldn't science come first, changed recommendations second? Any pro-mask study completed after April 2020 must dot every "i" and cross every "t" to be included on this site.

(2) Most pro-mask studies do not do this. They rely on correlation, not causation. They study droplets in idealized lab conditions, often using mannequins instead of real people. They do not study transmission. They do not take into account real world usage, humidity, and other factors that will affect the cleanliness and quality of the masks. They do not look at the leakage that comes out the side of the masks.

As of this time, only one RCT exists that is supportive of masking (Abaluck, et al), informally known as the "Bangladesh study," but it has yet to pass peer-review. Released as a pre-print on August 31, 2021, the Bangladesh study measured the impact of mask promotion on symptom reporting.

The Bangladesh study failed in several respects: The authors did not investigate what percentages of each population already had natural immunity to COVID-19. This fact, on its own, invalidates the whole study. But it gets worse. The authors also failed to isolate masks as the only variable that might lead to changed outcomes. (For instance, physical distancing also increased during the duration of the study, as the authors acknowledge. Did hand washing? The authors failed to document these variables.) The Bangladesh study has numerous additional limitations.

For an excellent analysis of the critical differences between the observational pro-mask studies and the RCTs casting doubt on the efficacy of masks, please read this article.

Last Updated: October 11, 2021

Exhibit AH

THE SECRETARY OF EDUCATION
WASHINGTON, DC 20202

March 17, 2021

Dear [Commissioner] XXXXX:

As we take a historic step forward together in helping schools reopen and remain open safely with enactment of the *American Rescue Plan (ARP) Act of 2021*, I want to recognize the extraordinary, ongoing efforts of you and your colleagues in confronting the challenges of the COVID-19 pandemic. We appreciate the work you have done to continue to ensure that America's students receive the high-quality education they deserve.

On Thursday, President Biden signed into law the ARP, which will deliver critical aid to States (as well as the Commonwealth of Puerto Rico and the District of Columbia), districts, schools, educators, students, and families as the country continues to recover from the COVID-19 pandemic. Today, the U.S. Department of Education (Department) is announcing the allocation that each State, the Commonwealth of Puerto Rico, and the District of Columbia will receive under the American Rescue Plan Elementary and Secondary School Emergency Relief (ARP ESSER) Fund. We will move quickly to get these vital resources to you.

It is with this same sense of urgency that State educational agencies (SEAs) and school districts should plan to expend these funds to safely reopen schools as expeditiously as possible this spring, sustain their healthy operations, and address the significant academic, social, emotional, and mental health needs of their students.

I am pleased to announce that the Department will award $XX,XXX,XXX to [State] in ARP ESSER funds. ARP ESSER funds will allow SEAs to take additional steps to safely reopen schools for in-person instruction and keep them open, and to address the disruptions to teaching and learning resulting from the pandemic. This includes using funds to enact appropriate measures to help schools to invest in mitigation strategies consistent with the Centers for Disease Control and Prevention's (CDC) Operational Strategy for K-12 Schools to the greatest extent practicable; address the many impacts of COVID-19 on students, including from interrupted instruction; implement strategies to meet students' social, emotional, mental health, and academic needs; offer crucial summer, afterschool, and other extended learning and enrichment programs; support early childhood education; invest in staff capacity; and avoid devastating layoffs at this critical moment, ensuring that all students have access to teachers, counselors, and other school personnel to support their needs.

The Department is committed to supporting SEAs in implementing these unprecedented resources. ARP ESSER funding will enable SEAs to promote safe school operations and equity-driven, sustainable, evidence-based programs to serve students – especially those who are the furthest from opportunity – and to continue to strengthen teaching and learning. You have my promise that the Department will do everything in

Exhibit AH

its power to respond efficiently to your questions, provide robust technical assistance and guidance to support evidence-based local decision-making, and put students first as we assist SEAs and local educational agencies in utilizing the ARP ESSER funding.

Recognizing the immediate challenges facing our schools and students, the Department will begin to make ARP ESSER funds available to States this month. You will soon receive a Grant Award Notification (GAN) through the Federal grants management system (G5) providing access to ARP ESSER funds as well as the terms and conditions for their use.

It is particularly important that ARP ESSER funding will enable State and local educational agencies, as well as schools, to support students who have been most severely impacted by the pandemic, which has even further exacerbated the inequities in our education system. Consistent with specific set-aside requirements at the State and district level and provisions for maintenance of equity, Federal relief funds can be used to equitably expand opportunities for the students who need the funds most, including students from lowincome backgrounds, students of color, students with disabilities, English learners, students experiencing homelessness or trauma, and students without access to technology.

The attached table shows State allocations for ARP ESSER funds. These allocations are based on the proportion of funds that each State received under Part A of Title I of the Elementary and Secondary Education Act of 1965 in fiscal year 2020. If you or your staff have questions, please reach out to us directly or submit questions to your State's program officer using your State's Office of Elementary and Secondary Education (OESE) Mailbox: [State].oese@ed.gov.

With ARP ESSER and other funds, the American Rescue Plan represents an extraordinary commitment to the Nation's students from early childhood to postsecondary education – and to our shared future. You can find the ARP ESSER Fund fact sheet attached.

Thank you for your hard work and continued commitment to students in your State.

Sincerely,

Miguel A. Cardona, EdD
Secretary
U.S. Department of Education

Oregon ARP ESSER Fact Sheet

Total ARP ESSER allocation for Oregon: $1,121,814,984
ARP ESSER funding released to Oregon on March 24, 2021: $747,352,489
ARP ESSER funding released to Oregon on July 15, 2021: $374,462,495
2020-2021 Preliminary Statewide Enrollment: 560,917

Top Priorities within Oregon's plan:

- Addressing unfinished learning by accelerating learning and building on strengths
- Prioritizing health, safety, wellness, and connections for all communities
- Strengthening high-quality, culturally sustaining instruction, leadership, and pathways to graduation and post-secondary transitions

Highlights of Oregon's Plan:

- **Returning to In Person Learning in 2021:** Oregon intends to provide in-person instruction to all students in the state for the 2021-2022 school year.

- **Safely Reopening Schools and Sustaining Safe Operations:** Returning to in-person instruction and the safe operation of school facilities are Oregon's highest priorities. To support schools with safe operations and returning to in-person instruction in the 2020-21 school year, the Oregon Department of Education (ODE) partnered with the Oregon Health Authority and used CDC guidance to develop the Ready Schools Safe Learners (RSSL) Guidance. This guidance included both requirements and recommendations on health and safety protocols. The health and safety aspects of RSSL applied to all Oregon districts, public charter schools, and private schools, and was updated regularly throughout the pandemic as Executive Orders from the Governor and guidance from the CDC changed. In addition, ODE created supplementary supports, aligned with the RSSL, to communicate, respond to, and understand the on-the-ground needs of its schools. ODE will continue to provide guidance, technical assistance, and professional development to support the return to in-person instruction.

- **Addressing the Academic Impact of Lost Instructional Time:** ODE will select evidence-based interventions to support accelerated learning to expand opportunities to students currently and historically underserved by the education system. This will include the selection of evidence-based intervention to support Career, College and Community Readiness by working with districts and other educational partners to reengage high school students who have been disconnected from their schools or communities as a result of COVID-19. ODE also will design tools and resources for teaching and learning, such as formative assessment practices; professional learning opportunities for educators on learning acceleration, culturally affirming and sustaining pedagogy, and technology-enabled instruction; and culturally responsive instructional materials.

- **Supporting Students Most Impacted by the Pandemic:** ODE will select specific interventions designed to address the academic impact of lost instructional time on historically underserved students and students that have been disproportionately impacted by the COVID-19 pandemic. ODE will use data to identify students missing the most in-person instruction and evaluate the level of participation by attendance and enrollment data.

- **Investing in Summer Learning and Expanded Afterschool Programs:** ODE will develop a process to grant districts and educational entities funds to identify, create, and employ effective summer programming outreach strategies to recruit and retain students who missed the most in-person instruction and students who did not consistently participate in remote instruction during the 2020-21 school year. ODE also will establish a process with ARP ESSER funds to create high-quality out-of-school programs through the application of evidence-based practice to address unfinished learning and increase opportunities that elevate relationships, enrichment, and well-rounded learning that matters to students.

- **Community Engagement and Consultation:** ODE's engagement led to the development of six critical bodies of guidance and will shape how ODE guides districts in planning to use their funds. Resources include: Equity in Education Investment Framework; Student Learning: Unfinished, Not Lost; a Mental Health Toolkit, Summer Learning Best Practice Guide, and multiple student advisory group plans. ODE plans to continue engaging with stakeholders throughout the coming months.

When Oregon LEA Use of Funds Plans will be due: Aug. 22, 2021

Exhibit AI

State Plan for the American Rescue Plan Elementary and Secondary School Emergency Relief Fund

U.S. Department of Education

Issued: April 21, 2021

OMB Number: 1810-0754
Expiration Date: October 31, 2021

Paperwork Burden Statement According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless such collection displays a valid OMB control number. The valid OMB control number for this information collection is 1810-0754. Public reporting burden for this collection of information is estimated to average 100 hours per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. The obligation to respond to this collection is required to obtain or retain benefit under Section 2001 of the American Rescue Plan Act of 2021 (ARP Act). If you have any comments concerning the accuracy of the time estimate, suggestions for improving this individual collection, or if you have comments or concerns regarding the status of your individual form, application or survey, please contact Britt Jung, Office of State and Grantee Relations, Office of Elementary and Secondary Education, U.S. Department of Education, 400 Maryland Avenue, SW, Washington, DC 20202-6450, email: SGR@ed.gov directly.

Exhibit AI

Introduction

The American Rescue Plan Elementary and Secondary School Emergency Relief ("ARP ESSER") Fund, authorized under the American Rescue Plan ("ARP") Act of 2021, provides nearly $122 billion to States to support the Nation's schools in safely reopening and sustaining safe operations of schools while meeting the academic, social, emotional, and mental health needs of students resulting from the coronavirus disease 2019 ("COVID-19") pandemic. It is particularly important that ARP ESSER funding will enable States and local educational agencies ("LEAs"), and more directly schools, to support students who have been most severely impacted by the COVID-19 pandemic and are likely to have suffered the most because of longstanding inequities in our communities and schools that have been exacerbated by the COVID-19 pandemic.

The U.S. Department of Education ("Department") is committed to working in partnership with States so that these unprecedented resources are quickly put to work to ensure students have sustained access to in-person instruction and that the resources are used to provide the effective support students need as they persist through and recover from the impacts of the COVID-19 pandemic. The thoughtful and timely use of these funds will have a lasting impact on our Nation's schools and help to address the inequities in resources, services, and opportunities available to our students.

This template presents an opportunity for States to share their plans for the use of ARP ESSER funds with the public. The Department must approve a State educational agency's ("SEA's") plan in order to make the State's remaining ARP ESSER allocation available for use. Please note that the Department intends to issue ARP ESSER reporting requirements separately.

Instructions

Each SEA must provide descriptions and other information that address each requirement listed below. An SEA may use this template or another format as long as every item and element is addressed in the SEA's response. Throughout this document, questions that refer to an SEA's ARP ESSER funding are referencing the total allocation to be received by the SEA, including that which it allocates to its LEAs.

Each SEA must submit to the Department by **June 7, 2021,** either: (1) its ARP ESSER plan or (2) the State requirements that preclude submission of the plan by that date and a date by which it will be able to submit its complete ARP ESSER plan.

To submit the SEA's plan, please email the plan to your Program Officer at [State].OESE@ed.gov (e.g., Alabama.OESE@ed.gov).

In order to ensure transparency, the Department will post each plan on the Department's website when it is received and will indicate each plan's approval status.

This template also allows States to fulfill the requirement of the Coronavirus Response and Relief Supplemental Appropriations ("CRRSA") Act ESSER II 6-month reporting requirement in section 313(f) of the CRRSA Act.

Cover Page

Grantee and Contact Information

ARP ESSER PR Award Number (e.g., S425U2100XX):

SEA Contact:

Telephone:

Email address:

By signing this document, I agree to each of the assurances listed in Appendix C and further assure that: To the best of my knowledge and belief, all information and data included in this plan are true and correct.	
Chief State School Officer or Authorized Representative (Printed Name)	
Signature of Authorized SEA Representative	Date:

A. Describing the State's Current Status and Needs

The Department recognizes the extraordinary efforts made by States, LEAs, and educators to support students during the COVID-19 pandemic. In this section, SEAs will describe the progress they have made, the priorities and student needs guiding their ARP ESSER funding decisions, and their current and projected operating status.

1. Progress and Promising Practices: Provide your assessment of the top 2-3 strategies that have been most effective in supporting the needs of students in your State during the COVID-19 pandemic, especially for students most impacted by the COVID-19 pandemic. Please include, if applicable, how your State will submit and encourage its LEAs to submit lessons learned and best practices to the Department's *Safer Schools and Campuses Best Practices Clearinghouse* so that they can be shared with other States and LEAs.
   Click here to enter text.

2. Overall Priorities: Provide your assessment of the top 2-3 issues currently facing students and schools across your State as a result of or in response to the COVID-19 pandemic including, to the extent possible, data illustrating why these are the most critical and/or most widespread issues facing schools and students.
   Click here to enter text.

3. Identifying Needs of Underserved Students: Describe your State's 2-3 highest priority academic, social, emotional, and/or mental health needs for the remainder of the 2020-2021 school year (if applicable) and for the 2021-2022 school year related to the impact of the COVID-19 pandemic on each of the following student groups:
   i. Students from low-income families,
   ii. Students from each racial or ethnic group (e.g., identifying disparities and focusing on underserved student groups by race or ethnicity),
   iii. Gender (e.g., identifying disparities and focusing on underserved student groups by gender),
   iv. English learners,
   v. Children with disabilities (including infants, toddlers, children, and youth with disabilities eligible under the Individuals with Disabilities Education Act ("IDEA")),
   vi. Students experiencing homelessness,
   vii. Children and youth in foster care,
   viii. Migratory students, and
   ix. Other groups disproportionately impacted by the pandemic that have been identified by the SEA (e.g., youth involved in the criminal justice system, students who have missed the most in-person instruction during the 2019-2020 and 2020-2021 school years, students who did not consistently participate in remote instruction when offered during school building closures, and LGBTQ+ students).

To the extent possible, this description should include data on indicators such as estimates of the academic impact of lost instructional time,[1] chronic absenteeism, student engagement, and social-emotional well-being.

Complete the table below, adding rows as necessary, or provide a narrative description.

Table A1.

Student group	Highest priority needs
Students from low-income families	
Students from each racial or ethnic background used by the State for reporting purposes – please add a row for each racial or ethnic group (e.g., identifying disparities and focusing on underserved student groups by race/ethnicity)	
Students by gender – please add a row for each gender (e.g., identifying disparities and focusing on underserved student groups by gender)	
English learners	
Children with disabilities	
Students experiencing homelessness	
Children and youth in foster care	
Migratory students	
Other groups of students identified by the State (e.g., youth involved in the criminal justice system, students who have missed the most in-person instruction during the 2019-2020 and 2020-2021 school years, students who did not consistently participate in remote instruction when offered during school building closures, LGBTQ+ students)	

4. Understanding the Impact of the COVID-19 Pandemic: Describe how the SEA will support its LEAs in identifying the extent of the impact of the COVID-19 pandemic on student learning and student well-being, including identifying the groups of students most impacted by the pandemic. Where possible, please identify the data sources the SEA will suggest its LEAs use in thoughtfully diagnosing areas of need, including data on the academic, social, emotional, and mental health impacts of lost instructional time.
Click here to enter text.

[1] For the purposes of the plan, "academic impact of lost instructional time" refers to "learning loss" experienced by students as a result of the COVID-19 pandemic, as referenced in the ARP Act and the CRRSA Act.

5. School Operating Status: It is essential to have data on how students are learning in order to support the goals of access and equity, especially for student groups that have been disproportionately impacted by the COVID-19 pandemic. Describe the current status of data collection on operational status and mode of instruction of all schools in your State. This description must include:
   i. A description of to what extent, and how frequently, the State collects now and will collect in the future data for all schools in your State on:
      a. Mode of instruction: The number of schools in your State that are offering fully remote or online-only instruction; both remote/online and in-person instruction (hybrid model); and/or full-time in-person instruction;
      b. Enrollment: Student enrollment for all students and disaggregated for each of the student groups described in A.3.i-viii for each mode of instruction; and
      c. Attendance: Student attendance for all students and disaggregated for each of the student groups described in A.3.i-viii for each mode of instruction.

      Click here to enter text.
   ii. The data described in A.5.i.a. and b. using the template in Appendix A (and to the extent available, the data described in A.5.i.c.) for the most recent time period available. Please note that this data can be submitted separately within 14 calendar days after a State submits this plan. The SEA must also make this data publicly available on its website as soon as possible but no later than June 21, 2021, and regularly provide updated available information on its website. The Department will periodically review data listed in A.5.i on SEA websites.

      Click here to enter text.
   iii. To the extent available, a description of the planned operational status and mode of instruction for the State and its LEAs for Summer 2021 and for the 2021-2022 school year.

      Click here to enter text.

B. Safely Reopening Schools and Sustaining their Safe Operations

The Department recognizes that safely reopening schools and sustaining their safe operations to maximize in-person instruction is essential for student learning and student well-being, and especially for being able to address the educational inequities that have been worsened by the COVID-19 pandemic. In this section, SEAs will describe how they will support their LEAs in this vital area.

1. Support for LEAs: Describe how the SEA will support its LEAs in safely returning to in-person instruction and sustaining the safe operation of schools. This description must include:

i. How the SEA will support its LEAs implementing, to the greatest extent practicable, prevention and mitigation policies in line with the most up-to-date guidance from the Centers for Disease Control and Prevention ("CDC") for the reopening and operation of school facilities to effectively maintain the health and safety of students, educators, and other staff;

Complete the table below, adding rows as necessary, or provide a narrative description.

Table B1.

Mitigation strategy	SEA response
Universal and correct wearing of masks	
Physical distancing (e.g., including use of cohorts/podding)	
Handwashing and respiratory etiquette	
Cleaning and maintaining healthy facilities, including improving ventilation	
Contact tracing in combination with isolation and quarantine, in collaboration with the State, local, territorial, or Tribal health departments	
Diagnostic and screening testing	
Efforts to provide vaccinations to educators, other staff, and students, if eligible	
Appropriate accommodations for children with disabilities with respect to the health and safety policies	

ii. Any Statewide plans, policies, estimated timelines, and specific milestones related to reopening and operation of school facilities, including any mechanisms the SEA will use to track, monitor, or enforce their implementation;
Click here to enter text.

iii. To what extent the SEA and its LEAs consult with Federal, State, and local health officials. This description should include, if available, whether the SEA and its LEAs have received support for screening testing from their State or local health department based on funding awarded by the CDC; and
Click here to enter text.

iv. Any guidance, professional learning, and technical assistance opportunities the SEA will make available to its LEAs.
Click here to enter text.

2. Safe Return to In-Person Instruction and Continuity of Services Plans: Describe how the SEA will ensure that its LEAs that receive ARP ESSER funds meet the requirements in section 2001(i) of the ARP Act and the requirements relating to the ARP ESSER funds published in the Federal Register and available at https://oese.ed.gov/offices/american-rescue-plan/american-rescue-plan-elementary-and-secondary-school-emergency-relief/ (ARP ESSER requirements) to either: (a) within 30 days of receipt of the funds, develop and make publicly available on the LEA's website a plan for the safe return to in-person instruction and continuity of services, or (b) have developed and made publicly available on the LEA's website such a plan that meets statutory requirements before the enactment of the ARP Act, including:
    i. How the SEA will ensure that each LEA plan includes, or will be modified to include, the extent to which it has adopted policies and a description of any such policies on each of the strategies listed in table B1;
    ii. How the SEA will ensure that each LEA plan describes how it will ensure continuity of services including but not limited to services to address the students' academic needs, and students' and staff social, emotional, mental health, and other needs, which may include student health and food services;
    iii. How the SEA will ensure that the LEA periodically reviews, no less frequently than every six months for the duration of the ARP ESSER grant period (i.e., through September 30, 2023),[2] and revises as appropriate, its plan, and how the SEA will ensure that the LEA seeks public input, and takes such input into account on (1) whether revisions are necessary and, if so, (2) the revisions to the plan; and
    iv. Describe, to the extent the SEA collects it, information about LEA implementation, to the greatest extent practicable, of each element of the most up-to-date CDC guidance listed in table B1 and its LEAs' needs for support and technical assistance to implement strategies consistent, to the greatest extent practicable, with relevant CDC guidance.

Click here to enter text.

C. Planning for the Use and Coordination of ARP ESSER Funds

The Department recognizes that seeking input from diverse stakeholders is essential to developing plans for the use of ARP ESSER funds that are responsive to the needs of students, families, and educators. In this section, SEAs will describe their plans for consultation and for coordinating the use of ARP ESSER funds with other resources to meet the needs of students.

[2] ARP ESSER funds are subject to the Tydings amendment in section 421(b) of the General Education Provisions Act, 20 U.S.C. 1225(b), and are therefore available to SEAs and LEAs for obligation through September 30, 2024. Review and revisions of these plans, if necessary, are not required during the Tydings period.

1. SEA Consultation: Consistent with the ARP ESSER requirements, describe how the SEA engaged in meaningful consultation with stakeholders, and incorporated input into its plan, including, but not limited to:
   i. students;
   ii. families;
   iii. Tribes (if applicable);
   iv. civil rights organizations (including disability rights organizations);
   v. school and district administrators (including special education administrators);
   vi. superintendents;
   vii. charter school leaders (if applicable);
   viii. teachers, principals, school leaders, other educators, school staff, and their unions; and
   ix. stakeholders representing the interests of children with disabilities, English learners, children experiencing homelessness, children and youth in foster care, migratory students, children who are incarcerated, and other underserved students.

   The description must include how the SEA provided the public the opportunity to provide input in the development of the plan, a summary of the input (including any letters of support), and how the SEA took such input into account.
   Click here to enter text.

2. Coordinating Funds: Describe to what extent the SEA has and will coordinate Federal COVID-19 pandemic funding and other Federal funding. This description must include:
   i. How the SEA and its LEAs 1) are using or have used prior to the submission of this plan and 2) plan to use following submission of this plan, Federal COVID-19 funding under the Coronavirus Aid, Relief, and Economic Security ("CARES") Act and the CRRSA Act to support a safe return to and safely maximize in-person instruction, sustain these operations safely, and address the disproportionate impact of the COVID-19 pandemic on individual student groups (including students from low-income families, children with disabilities, English learners, racial or ethnic minorities, students experiencing homelessness, children and youth in foster care, and migratory students);

      Complete the table below or provide a narrative description.

      Table C1.

Funding source	Prior/current SEA and LEA uses (including funding amounts, if applicable)	Planned SEA and LEA uses (including funding amounts, if applicable)
ESSER I (CARES Act)		
GEER I (CARES Act)		
ESSER II (CRRSA Act)		
GEER II (CRRSA Act)		

ii. To what extent ESSER I and ESSER II funds have been awarded to LEAs and, if funds have not yet been made available to LEAs, when they will be. In addition, please provide any available information on the total dollar amounts of ESSER I and ESSER II funds that have been obligated but not expended by the SEA and its LEAs, including whether the SEA is able to track LEA obligations.
Click here to enter text.

iii. In supporting LEAs as they plan for the safe return to and continuity of in-person instruction and for meeting the academic, social, emotional, and mental health needs of students resulting from the COVID-19 pandemic, the extent to which the SEA is also using other Federal funding sources including but not limited to under the Elementary and Secondary Education Act of 1965 ("ESEA"), IDEA, Workforce Innovation and Opportunity Act ("WIOA"), funding for child nutrition services, and McKinney-Vento Homeless Assistance Act, and the funds to support the needs of students experiencing homelessness provided by section 2001(b)(1) of the ARP Act.[3]
Click here to enter text.

D. Maximizing State-Level Funds to Support Students

The Department recognizes that States have an extraordinary opportunity to address the disproportionate impact of the COVID-19 pandemic on underserved students through the ARP Act's required State set-asides to address the academic impact of lost instructional time, provide summer learning and enrichment programs, and provide comprehensive afterschool programs. In this section, SEAs will describe their evidence-based strategies for these resources.

[3] Please note that the needs of students experiencing homelessness must be addressed (along with the other groups disproportionately impacted by the COVID-19 pandemic) through the use of the ARP ESSER SEA reservations and the required LEA reservation for the academic impact of lost instructional time; the funding provided to support the needs of students experiencing homelessness by section 2001(b)(1) of the ARP Act is in addition to the supports and services provided with ARP ESSER funds.

1. Academic Impact of Lost Instructional Time: Describe how the SEA will use the funds it reserves under section 2001(f)(1) of the ARP Act (totaling not less than 5 percent of the State's total allocation of ARP ESSER funds) on evidence-based interventions to address the academic impact of lost instructional time by supporting the implementation of evidence-based interventions, such as summer learning or summer enrichment, extended day, comprehensive afterschool programs, or extended school year programs, and ensure that such interventions respond to students' academic, social, emotional, and mental health needs. The description must include:
   i. A description of the evidence-based interventions (e.g., providing intensive or high-dosage tutoring, accelerating learning) the SEA has selected, and the extent to which the SEA will evaluate the impact of those interventions on an ongoing basis to understand if they are working;
   Click here to enter text.
   ii. How the evidence-based interventions will specifically address the disproportionate impact of COVID-19 on certain groups of students, including each of the student groups listed in question A.3.i.-viii. When possible, please indicate which data sources the SEA will use to determine the impact of lost instructional time; and
   Click here to enter text.
   iii. The extent to which the SEA will use funds it reserves to identify and engage 1) students who have missed the most in-person instruction during the 2019-2020 and 2020-2021 school years; and 2) students who did not consistently participate in remote instruction when offered during school building closures.
   Click here to enter text.

2. Evidence-Based Summer Learning and Enrichment Programs: Describe how the SEA will use the funds it reserves under section 2001(f)(2) of the ARP Act (totaling not less than 1 percent of the State's total allocation of ARP ESSER funds) for evidence-based summer learning and enrichment programs, including those that begin in Summer 2021, and ensure such programs respond to students' academic, social, emotional, and mental health needs. The description must include:
   i. A description of the evidence-based programs that address the academic, social, emotional, and mental health needs of students (e.g., providing intensive or high-dosage tutoring, accelerating learning) the SEA has selected, and the extent to which the SEA will evaluate the impact of those programs;
   Click here to enter text.
   ii. How the evidence-based programs will specifically address the disproportionate impact of COVID-19 on certain groups of students, including each of the student groups listed in question A.3. i.--viii. When possible, please indicate which data sources the SEA will use

to identify students most in need of summer learning and enrichment programs; and

Click here to enter text.

iii. The extent to which the SEA will use funds it reserves to identify and engage 1) students who have missed the most in-person instruction during the 2019-2020 and 2020-2021 school years; and 2) students who did not consistently participate in remote instruction when offered during school building closures.

Click here to enter text.

3. Evidence-Based Comprehensive Afterschool Programs: Describe how the SEA will use the funds it reserves under section 2001(f)(3) of the ARP Act (totaling not less than 1 percent of the State's total allocation of ARP ESSER funds) for evidence-based comprehensive afterschool programs (including, for example, before-school programming), and ensure such programs respond to students' academic, social, emotional, and mental health needs. The description must include:

   i. A description of the evidence-based programs (e.g., including partnerships with community-based organizations) the SEA has selected, and the extent to which the SEA will evaluate the impact of those programs;

   Click here to enter text.

   ii. How the evidence-based programs will specifically address the disproportionate impact of COVID-19 on certain groups of students, including each of the student groups listed in question A.3.i.-viii. When possible, please indicate which data sources the SEA will use to identify students most in need of comprehensive afterschool programming; and

   Click here to enter text.

   iii. the extent to which the SEA will use funds it reserves to identify and engage 1) students who have missed the most in-person instruction during the 2019-2020 and 2020-2021 school years; and 2) students who did not consistently participate in remote instruction when offered during school building closures.

   Click here to enter text.

4. Emergency Needs: If the SEA plans to reserve funds for emergency needs under section 2001(f)(4) of the ARP Act to address issues responding to the COVID-19 pandemic, describe the anticipated use of those funds, including the extent to which these funds will build SEA and LEA capacity to ensure students' and staff's health and safety; to meet students' academic, social, emotional, and mental health needs; and to use ARP ESSER funds to implement evidence-based interventions.

   Click here to enter text.

E. Supporting LEAs in Planning for and Meeting Students' Needs

The Department recognizes that the safe return to in-person instruction must be accompanied by a focus on meeting students' academic, social, emotional, and mental health needs, and by addressing the opportunity gaps that existed before – and were exacerbated by – the pandemic. In this section, SEAs will describe how they will support their LEAs in developing high-quality plans for LEAs' use of ARP ESSER funds to achieve these objectives.

1. LEA Plans for the Use of ARP ESSER Funds: Describe what the SEA will require its LEAs to include in LEA plans consistent with the ARP ESSER requirements for the use of ARP ESSER funds, how the SEA will require such plans to be made available to the public, and the deadline by which the LEA must submit its ARP ESSER plan (which must be a reasonable timeline and should be within no later than 90 days after receiving its ARP ESSER allocation). The LEA plans must include, at a minimum:
    - i. The extent to which and how the funds will be used to implement prevention and mitigation strategies that are, to the greatest extent practicable, in line with the most recent CDC guidance, in order to continuously and safely operate schools for in-person learning;
    - ii. How the LEA will use the funds it reserves under section 2001(e)(1) of the ARP Act (totaling not less than 20 percent of the LEA's total allocation of ARP ESSER funds) to address the academic impact of lost instructional time through the implementation of evidence-based interventions, such as summer learning or summer enrichment, extended day, comprehensive afterschool programs, or extended school year programs;
    - iii. How the LEA will spend its remaining ARP ESSER funds consistent with section 2001(e)(2) of the ARP Act; and
    - iv. How the LEA will ensure that the interventions it implements, including but not limited to the interventions under section 2001(e)(1) of the ARP Act to address the academic impact of lost instructional time, will respond to the academic, social, emotional, and mental health needs of all students, and particularly those students disproportionately impacted by the COVID-19 pandemic, including students from low-income families, students of color, English learners, children with disabilities, students experiencing homelessness, children and youth in foster care, and migratory students.

    Click here to enter text.

2. LEA Consultation: Describe how the SEA will, in planning for the use of ARP ESSER funds, ensure that, consistent with the ARP ESSER requirements], its LEAs engage in meaningful consultation with stakeholders, including, but not limited to:
    - i. students;
    - ii. families;

iii. school and district administrators (including special education administrators); and
iv. teachers, principals, school leaders, other educators, school staff, and their unions.

The LEA must also engage in meaningful consultation with each of the following to the extent present in or served by the LEA:

i. Tribes;
ii. civil rights organizations (including disability rights organizations); and
iii. stakeholders representing the interests of children with disabilities, English learners, children experiencing homelessness, children and youth in foster care, migratory students, children who are incarcerated, and other underserved students.

The description must also include how the SEA will ensure that LEAs provide the public the opportunity to provide input in the development of the LEA's plan for the use of ARP ESSER funds and take such input into account.
Click here to enter text.

3. Describe how the SEA will support and monitor its LEAs in using ARP ESSER funds. The description must include:
   i. How the SEA will support and monitor its LEAs' implementation of evidence-based interventions that respond to students' academic, social, emotional, and mental health needs, such as through summer learning or summer enrichment, extended day, comprehensive afterschool programs, or extended school year programs – including the extent to which the SEA will collect evidence of the effectiveness of interventions employed;
   Click here to enter text.
   ii. How the SEA will support and monitor its LEAs in specifically addressing the disproportionate impact of the COVID-19 pandemic on certain groups of students, including each of the student groups listed in question A.3.i.-viii; and
   Click here to enter text.
   iii. How the SEA will support and monitor its LEAs in using ARP ESSER funds to identify, reengage, and support students most likely to have experienced the impact of lost instructional time on student learning, such as:
      a. Students who have missed the most in-person instruction during the 2019-2020 and 2020-2021 school years;
      b. Students who did not consistently participate in remote instruction when offered during school building closures; and
      c. Students most at-risk of dropping out of school.
   Click here to enter text.

4. Describe the extent to which the SEA will support its LEAs in implementing additional strategies for taking educational equity into account in expending ARP ESSER funds, including but not limited to:
    i. Allocating funding both to schools and for districtwide activities based on student need, and
    ii. Implementing an equitable and inclusive return to in-person instruction. An inclusive return to in-person instruction includes, but is not limited to, establishing policies and practices that avoid the over-use of exclusionary discipline measures (including in- and out-of-school suspensions) and creating a positive and supportive learning environment for all students.

    Click here to enter text.

F. Supporting the Educator Workforce

The Department recognizes the toll that the COVID-19 pandemic has taken on the Nation's educators as well as students. In this section, SEAs will describe strategies for supporting and stabilizing the educator workforce and for making staffing decisions that will support students' academic, social, emotional, and mental health needs.

1. Supporting and Stabilizing the Educator Workforce:
    i. Describe the extent to which the State is facing shortages of educators, education administration personnel, and other school personnel involved in safely reopening schools, and the extent to which they vary by region/type of school district and/or groups of educators (e.g., special educators and related services personnel and paraprofessionals; bilingual or English as a second language educators; science, technology, engineering, and math ("STEM") educators; career and technical education ("CTE") educators; early childhood educators). Cite specific data on shortages and needs where available.

    Complete the table below, changing or adding additional rows as needed, or provide a narrative description.

Table F1.

Area	Data on shortages and needs	Narrative description
Special educators and related service personnel and paraprofessionals		
Bilingual educators		
English as a second language educators		
STEM educators		
CTE educators		

Area	Data on shortages and needs	Narrative description
Early childhood educators		
School counselors		
Social workers		
Nurses		
School psychologists		

ii. Describe how the SEA will assist its LEAs in identifying the most urgent areas of shortages or potential shortages, with particular plans for individual LEAs facing the most significant needs (e.g., by avoiding layoffs, providing high-quality professional learning opportunities, and addressing the impact of stress or trauma on educators). Include a description of how other Federal COVID-19 funding (e.g., ESSER and GEER funds under the CARES Act and CRRSA Act) have already been used to avoid layoffs during the COVID-19 pandemic.
Click here to enter text.

iii. Describe the actions the SEA will take to fill anticipated gaps in certified teachers for the start of the 2021-2022 school year and to what extent the SEA will further support its LEAs in expanding the educator pipeline and educator diversity while addressing the immediate needs of students disproportionately impacted by the pandemic (e.g., recruiting teaching candidates to provide high-dosage tutoring or implementing residencies for teacher candidates).
Click here to enter text.

2. Staffing to Support Student Needs: Describe the extent to which the SEA has developed or will develop strategies and will support its LEAs in increasing student access to key support staff within school buildings, including school counselors, special education personnel, nurses, social workers, and psychologists (e.g. hiring additional personnel or freeing up these staff to focus on providing services to students).
Click here to enter text.

G. Monitoring and Measuring Progress

The Department recognizes that transparency on how ARP ESSER funds are used and their impact on the Nation's education system is a fundamental responsibility of Federal, State, and local government. In this section, SEAs will describe how they are building capacity at the SEA and LEA levels to ensure high-quality data collection and reporting and to safeguard funds for their intended purposes.

1. Capacity for Data Collection and Reporting: It is important for an SEA to continuously monitor progress and make adjustments to its strategies, as well as to support its LEAs in making adjustments to LEA strategies, based on impact.

Describe how the SEA will ensure its capacity and the capacity of its LEAs to collect data on reporting requirements, including but not limited to the examples of reporting requirements described in the SEA's Grant Award Notification (listed in Appendix B). Describe the SEA's capacity and strategy to collect data from its LEAs (disaggregated by student group, where applicable), to the greatest extent practicable, including any steps the SEA will take to build its capacity in the future (which may include the use of ARP ESSER and other Federal COVID-19 pandemic funds at the SEA and LEA levels), on issues that may include the following:

i. Student learning, including the academic impact of lost instructional time during the COVID-19 pandemic;
ii. Opportunity to learn measures (e.g., chronic absenteeism; student engagement; use of exclusionary discipline; access to and participation in advanced coursework; access to technology, including educator access to professional development on the effective use of technology; access to high-quality educators; access to school counselors, social workers, nurses, and school psychologists; and results from student, parent, and/or educator surveys);
iii. Fiscal data that is comparable across the State (e.g., per-pupil expenditures at the LEA and school levels);
iv. Jobs created and retained (by position type);
v. Participation in programs funded by ARP ESSER resources (e.g., summer and afterschool programs); and
vi. Other reporting requirements reasonably required by the Secretary (please refer to Appendix B of this template; final requirements will be issued separately).

Click here to enter text.

2. Monitoring and Internal Controls: Describe how the SEA will implement appropriate fiscal monitoring of and internal controls for the ARP ESSER funds (e.g., by updating the SEA's plan for monitoring funds and internal controls under the CARES and CRRSA Acts; addressing potential sources of waste, fraud, and abuse; conducting random audits; or other tools). In this response, please describe the SEA's current capacity to monitor ARP ESSER; steps, if needed, to increase capacity; and any foreseeable gaps in capacity, including how the SEA will provide its LEAs with technical assistance in the anticipated areas of greatest need.

Click here to enter text.

Appendix A: School Operating Status and Instructional Mode Data Template

Indicate the date or time period represented by the following data.

Click here to enter text.

Table 1

In the most recent time period available, how many schools in your State offered each mode of instruction or learning model described below? Each row should account for all schools in your State, so that, for each row, the sum of the numbers in the "offered to all students," "offered to some students," and "not offered" columns is equal to the number in the "all schools" column.

Add or change rows as needed

Number of schools	All schools	Offered to all students	Offered to some students	Not offered
Remote or online only	#	#	#	#
School buildings open with both remote/online and in-person instruction (hybrid)	#	#	#	#
School buildings open with full-time in-person instruction	#	#	#	#

To the extent data are available, please complete the above table for 1) all schools in the State, and 2) separately for each instructional level (e.g., pre-kindergarten/elementary schools, middle schools, high schools).

Table 2

In the most recent time period available, what was the enrollment and mode of instruction for the schools in your State?

Add or change rows as needed

Number of students	Total enrollment	Remote or online only	Both remote/online and in-person instruction (hybrid)	Full-time in-person instruction
Students from low-income families	#	#	#	#
White, not Hispanic	#	#	#	#
Black or African American, not Hispanic	#	#	#	#
Hispanic, of any race	#	#	#	#
Asian, not Hispanic	#	#	#	#
American Indian or Alaskan Native, not Hispanic	#	#	#	#
Native Hawaiian or Pacific Islander, not Hispanic	#	#	#	#
Two or more races, not Hispanic	#	#	#	#
Race/Ethnicity information not available	#	#	#	#
English learners	#	#	#	#
Children with disabilities	#	#	#	#
Students experiencing homelessness	#	#	#	#
Children and youth in foster care	#	#	#	#
Migratory students	#	#	#	#

Appendix B: Reporting Language Included in the Grant Award Notification ("GAN")

As described in the Grant Award Notification ("GAN"), the SEA will comply with, and ensure that its LEAs comply with, all reporting requirements at such time and in such manner and containing such information as the Secretary may reasonably require, including on matters such as:

- How the State is developing strategies and implementing public health protocols including, to the greatest extent practicable, policies and plans in line with the CDC guidance related to mitigating COVID-19 in schools;
- Overall plans and policies related to State support for return to in-person instruction and maximizing in-person instruction time, including how funds will support a return to and maximize in-person instruction time, and advance equity and inclusivity in participation in in-person instruction;
- Data on each school's mode of instruction (fully in-person, hybrid, and fully remote) and conditions;
- SEA and LEA uses of funds to meet students' social, emotional, and academic needs, including through summer enrichment programming and other evidence-based interventions, and how they advance equity for underserved students;
- SEA and LEA uses of funds to sustain and support access to early childhood education programs;
- Impacts and outcomes (disaggregated by student subgroup) through use of ARP ESSER funding (e.g., quantitative and qualitative results of ARP ESSER funding, including on personnel, student learning, and budgeting at the school and district level);
- Student data (disaggregated by student subgroup) related to how the COVID-19 pandemic has affected instruction and learning;
- Requirements under the Federal Financial Accountability Transparency Act ("FFATA"); and
- Additional reporting requirements as may be necessary to ensure accountability and transparency of ARP ESSER funds.

Appendix C: Assurances

By signing this document, the SEA assures all of the following:

- The SEA will conduct all its operations so that no person shall be excluded from participation in, be denied the benefits of, or be subject to discrimination under the ARP ESSER program or activity based on race, color, national origin, which includes a person's limited English proficiency or English learner status and a person's actual or perceived shared ancestry or ethnic characteristics; sex; age; or disability. These non-discrimination obligations arise under Federal civil rights laws, including but not limited to Title VI of the Civil Rights Act of 1964, Title IX of the Education Amendments Act of 1972, section 504 of the Rehabilitation Act of 1973, and the Age Discrimination Act of 1975. In addition, the SEA must comply with all regulations, guidelines, and standards issued by the Department under any of these statutes;
- The SEA will comply with all ARP Act and other ARP ESSER requirements and all requirements of its Grant Award Notification, including but not limited to:
    - Complying with the maintenance of effort provision in section 2004(a)(1) of the ARP Act, absent a waiver by the Secretary pursuant to section 2004(a)(2) of the ARP Act; and
    - Complying with the maintenance of equity provisions in section 2004(b) of the ARP Act, and ensuring its LEAs comply with the maintenance of equity provision in section 2004(c) of the ARP Act (please note that the Department will provide additional guidance on maintenance of equity shortly);
- The SEA will allocate ARP ESSER funds to LEAs in an expedited and timely manner and, to the extent practicable, not later than 60 days after the SEA receives ARP ESSER funds (i.e., 60 days from the date the SEA receives each portion of its ARP ESSER funds). An SEA that is not able to allocate such funds within 60 days because it is not practicable (e.g., because of pre-existing State board approval requirements) will provide an explanation to the Department within 30 days of receiving each portion of its ARP ESSER funds (submitted via email to your Program Officer at [State].OESE@ed.gov (e.g., Alabama.OESE@ed.gov)), including a description of specific actions the SEA is taking to provide ARP ESSER funds to LEAs in an expedited and timely manner and the SEA's expected timeline for doing so;
- The SEA will implement evidence-based interventions as required under section 2001(f) of the ARP Act and ensure its LEAs implement evidence-based interventions, as required by section 2001(e)(1) of the ARP Act;
- The SEA will address the disproportionate impact of the COVID-19 pandemic on underserved students (i.e., students from low-income families, students from racial or ethnic groups (e.g., identifying disparities and focusing on underserved student groups by race or ethnicity), gender (e.g., identifying disparities and focusing on underserved student groups by gender), English learners, children with disabilities, students experiencing homelessness, children and youth in foster care, and migratory students), as required under section 2001(f) of the ARP Act, and ensure its LEAs address the disproportionate impact of the COVID-19 pandemic on underserved students (i.e., students from low-income families, students from racial or ethnic groups, gender, English learners, children with disabilities, students experiencing homelessness, children and

youth in foster care, and migratory students), as required by section 2001(e)(1) of the ARP Act; and

- The SEA will provide to the Department: (1) the URL(s) where the public can readily find data on school operating status and (2) the URL(s) for the SEA and/or LEA websites where the public can find the LEA plans for a) the safe return to in-person instruction and continuity of services required under section 2001(i) of the ARP Act, and b) use of ARP ESSER funds. SEAs should consider ensuring a standardized URL format in all cases (e.g., xxx.gov/COVIDplan).

Appendix D

OMB Control No. 1894-0005 (Exp. 06/30/2023)

NOTICE TO ALL APPLICANTS

The purpose of this enclosure is to inform you about a new provision in the Department of Educations General Education Provisions Act ("GEPA") that applies to applicants for new grant awards under Department programs. This provision is Section 427 of GEPA, enacted as part of the Improving America's Schools Act of 1994 (Public Law (P.L.) 103-382).

To Whom Does This Provision Apply?

Section 427 of GEPA affects applicants for new grant awards under this program. **ALL APPLICANTS FOR NEW AWARDS MUST INCLUDE INFORMATION IN THEIR APPLICATIONS TO ADDRESS THIS NEW PROVISION IN ORDER TO RECEIVE FUNDING UNDER THIS PROGRAM.**

(If this program is a State-formula grant program, a State needs to provide this description only for projects or activities that it carries out with funds reserved for State-level uses. In addition, local school districts or other eligible applicants that apply to the State for funding need to provide this description in their applications to the State for funding. The State would be responsible for ensuring that the school district or other local entity has submitted a sufficient section 427 statement as described below.)

What Does This Provision Require?

Section 427 requires each applicant for funds (other than an individual person) to include in its application a description of the steps the applicant proposes to take to ensure equitable access to, and participation in, its Federally-assisted program for students, teachers, and other program beneficiaries with special needs. This provision allows applicants discretion in developing the required description. The statute highlights six types of barriers that can impede equitable access or participation: gender, race, national origin, color, disability, or age. Based on local circumstances, you should determine whether these or other barriers may prevent your students, teachers, etc. from such access to, or participation in, the Federally-funded project or activity. The description in your application of steps to be taken to overcome these barriers need not be lengthy; you may provide a clear and succinct description of how you plan to address those barriers that are applicable to your circumstances. In addition, the information may be provided in a single narrative, or, if appropriate, may be discussed in connection with related topics in the application.

Section 427 is not intended to duplicate the requirements of civil rights statutes, but rather to ensure that, in designing their projects, applicants for Federal funds address equity concerns that may affect the ability of certain potential beneficiaries to fully participate in the project and to achieve high standards. Consistent with program requirements and its approved application, an applicant may use the Federal funds awarded to it to eliminate barriers it identifies.

What are Examples of How an Applicant Might Satisfy the Requirement of This Provision?

The following examples may help illustrate how an applicant may comply with Section 427.

(1) An applicant that proposes to carry out an adult literacy project serving, among others, adults with limited English proficiency, might describe in its application how it intends to distribute a brochure about the proposed project to such potential participants in their native language.

(2) An applicant that proposes to develop instructional materials for classroom use might describe how it will make the materials available on audio tape or in braille for students who are blind.

(3) An applicant that proposes to carry out a model science program for secondary students and is concerned that girls may be less likely than boys to enroll in the course, might indicate how it intends to conduct "outreach" efforts to girls, to encourage their enrollment.

(4) An applicant that proposes a project to increase school safety might describe the special efforts it will take to address concerns of lesbian, gay, bisexual, and transgender students, and efforts to reach out to and involve the families of LGBT students.

We recognize that many applicants may already be implementing effective steps to ensure equity of access and participation in their grant programs, and we appreciate your cooperation in responding to the requirements of this provision.

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Estimated Burden Statement for GEPA Requirements

According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless such collection displays a valid OMB control number. Public reporting burden for this collection of information is estimated to average 3 hours per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. The obligation to respond to this collection is required to obtain or retain benefit (Public Law 103-382). Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the U.S. Department of Education, 400 Maryland Ave., SW, Washington, DC 20210-4537 or email ICDocketMgr@ed.gov and reference the OMB Control Number 1894-0005.